

# Solo Course Design 2006

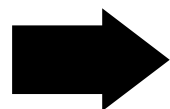
presented by  
Houston  
Region  
SCCA

assembled and updated by  
Roger H. Johnson  
Houston, Texas



Version 4.0

- Credits
  - This booklet is a plagiarism of the experiences of **Karen Babb, Gregg Lee, Jim Garry, Mark Sirota, Team.Net,** and myself, **Roger H. Johnson** (of no sheep and no yellow 'Vette)
- Today's presentation is broken up into 7 categories. A brief description of each of these categories follows:
  1. Fundamentals
  2. 10 Basic Concepts
  3. Simplicity and Big Event Administration
  4. So you have a blank piece of paper...
  5. Elements, dimensions and real speed
  6. Summary and Questions
- Then we will proceed outside and perform physical set up of selected items from the lecture, and drive through them (got your helmet?)
  - Discovering Visual Clarity
  - When a Maneuver is or isn't a Maneuver



- **Fundamentals**

- 10 Basic Concepts
- Simplicity and Big Event Administration
- So you have a Blank Piece of Paper...
- Elements, Dimensions and Real Speed
- Physical Application
- Summary and Questions

# Fundamentals

avoiding all that stuff that can  
mess up a perfectly good course

- **You will** check out the conditions of the surface
  - Avoid sections of the pavement that are breaking up or bumpy
  - Avoid patches or treated areas
  - Beware of fluid spills sticky tar, etc.
  - Avoid drainage grates, manhole covers, or any other non-movable objects
- **You will** consider placement of the course workers
  - Safe workstation positioning
    - Workers do not have to cross one part of the course to get to down cones on another part?
    - Station not placed in the path of a predicted spin point?
  - See all of the pylons within their responsibility?
  - Pylons close enough that the workers can get to them without delaying the start or causing a red flag?

# Fundamentals

(continued)

- **You will** allow for multiple cars (site allowing)
  - If necessary, can two cars (or more) safely be on course at once?
  - Do adjacent section conflicts prevent full use of the time available?
- **You will** thoughtfully place start and finish lines
  - Have you established clear access to the start and from the finish?
  - Avoid “drag race” starts to ensure a fair start for all competitors
    - Place a sharp turn immediately before or after the start lights
  - Provide a safe finish
    - Don’t point the finish towards nearby spectator areas
    - Allow plenty of room for a safe, non-dramatic shutdown
- **You will** thoughtfully place timing and scoring
  - Can timing crew easily read the car numbers and view the entire course?
  - Is the timing equipment and crew clearly out of harms way? (such as a spinning vehicle)



# How to Keep Your Solo II Peers from Killing You...

## Do Not

Get them Lost!

- DO NOT put in lots of extra meaningless pylons just to disguise the course
- DO NOT space pylons the same or similar distance as the gate width
- DO NOT forget to line the course

## Do Not

Make them hit (and pick up) lots of pylons!!

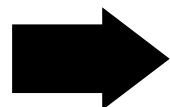
- DO NOT place a cone(s) with the only intent of “boy, will THAT one get creamed!”
- AVOID the effect known as the “Sea of Pylons”

# How to Keep Your Solo II Peers from Killing You...

(continued)

- Visit the site ahead of time
- Draw the course to scale (or as close as possible) and include:
  - Worker positions
  - Start and Finish
  - Grid
  - Paddock
- Let some other non-emotionally involved person review your course
- Set up early
- Walk the course while pretending some other idiot designed it
  - Look for visually confusing areas
  - Add pointers or adjust pylons as needed
  - Remove pylons as needed
- Have someone else walk the course and adjust according to their comments as necessary
- Then, line the course

- Fundamentals



- **10 Basic Concepts**

- Simplicity and Big Event Administration
- So you have a Blank Piece of Paper...
- Elements, Dimensions and Real Speed
- Physical Application
- Summary and Questions



# 10 Basic Concepts

- 1.) Be a Commercial Artist
- 2.) Use Creativity
- 3.) No Hidden Agendas
- 4.) Be Familiar with the Solo II Course Design Rules
- 5.) Make the Course Flow
- 6.) Use Elements that Favor Horsepower and Elements that Favor Handling
- 7.) Use Pointers and Directionals Correctly and Sparingly
- 8.) Line the Course, when possible
- 9.) Place Gates to Avoid Visual Confusion
- 10.) Walk/Drive Your Course with the Intent of Improvement

## 1.) Be a Commercial Artist

- As a course designer, you will become an artist; according to Webster, an artist is “one who professes and practices an imaginative art”
- Believe me, imagination is required to create a course that is interesting and fun to drive - and when the course design is completed, you will feel like you have created a piece of art!
  - A **Fine Artist** is:
    - An artist whose main goal is to please themselves, and then everyone else can like it or ‘stuff it’
  - A **Commercial Artist** is:
    - An artist whose main goal is to *please the customer*, while pleasing themselves as well

Be a **Commercial Artist** - not a Fine Artist

*10 Basic Concepts - Be a Commercial Artist*  
**How does a Commercial Artist  
Please the Customer?**

- Keep in mind, the main goal of course design is to provide the competitors with **Fair, Fun and Safe Competition.**
- After creating a course design, take copies of it to be reviewed and critiqued by your peers (never destroy the original).
  - Leave your pride at home!
  - Listen and hear to what they have to say
  - Ask them to explain the 'hows and whys' of their suggestion
  - Mark your map up with their suggestions and comments
- After the peer review, look over and analyze their comments, and then implement any that you feel improve your course design
  - Be true to your basic concept - put your own style into their suggestion if you wish; that is the reason you ask to understand the 'hows and whys'
  - Remember: The great thing about advice is that you don't have to take it - and you might actually learn or see something you had not thought about

# Judging your Success

(If you're yelling at me, should I assume you didn't like it?)

- Ask the competitors about your course directly and listen to what they have to say.
  - What did they like/dislike and why?
  - Know why, so that you can create/avoid that effect again
  - Listen to their comments so that you don't become a Fine Artist, who is usually more concerned with their pride than creating a course that everyone likes to drive
  - If a favorite element is criticized every time that you use it, it most likely is a poor element; re-think it - don't force your fellow competitors to accept a particular element just because it is an "old favorite" of yours
  - Try to 'eaves drop' for comments about the course
    - This is a good way to get their "true" feelings on the matter since they are not concerned with the embarrassment of offending you
  - Don't get discouraged if some people do not like the course
    - I have never designed a course that everybody likes
    - You can usually tell from the 'why' of their comments as to whether they are whining or have a valid point
    - Remember: those who have won will like it; those that didn't tend not to...

## Judging your success (continued)

- Did you receive **unsolicited praise** or **complaints**?
- Note the number of **delays** for course workers, course repair, etc.
- Track the number of **DNFs** for other than mechanical failure
  - The goal is zero:
    - acceptable is 1 in 20 on the first run, 1 in 100 there after
- Number and frequency of **pylons hit**
  - The goal is zero
  - Acceptable is 1 car in 10 hitting any; no more than 3 for any one car

Keep in mind, the main goal of course design is to provide the Solo II competitors with  
**Fair, Fun and Safe Competition.**

## 2.) Use Creativity

- Creativity is what makes a course interesting to drive
  - What is creativity in course design?
    - Taking a usual maneuver and changing to make it more interesting - not to make it painful!
    - Setting usual maneuvers in a visually different manner
    - Including a variety and number of different types of turns and transients and a sufficient input density
    - Placing enough challenge into a course without making it “painful”
    - Utilizing the “punish/reward” or “sacrifice/gain” concept
    - Creating situations where the driver must analyze the course carefully to find the fast line(s) - so that those with the right amount of skill, aggression, experience and discipline will be rewarded
    - Use chalk lines in a variety of visually interesting and helpful ways
- Be creative and innovative but avoid the bizarre
  - When you come up with a concept that you believe to be new and creative, take a moment to analyze it
    - Is it so creative that it has become bizarre?
      - If so, modify the idea or forget it, because it will not be well received by most drivers

# Application of Creativity

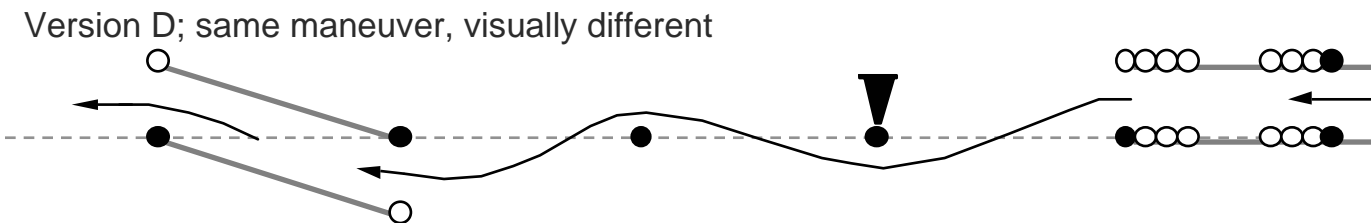
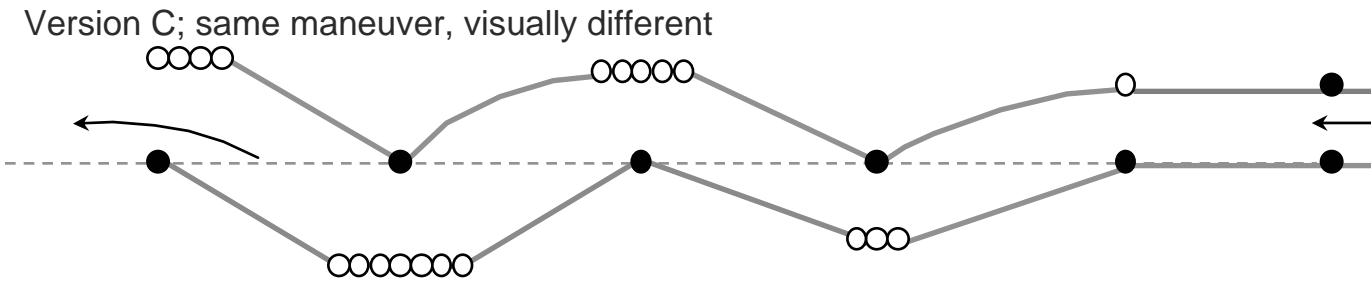
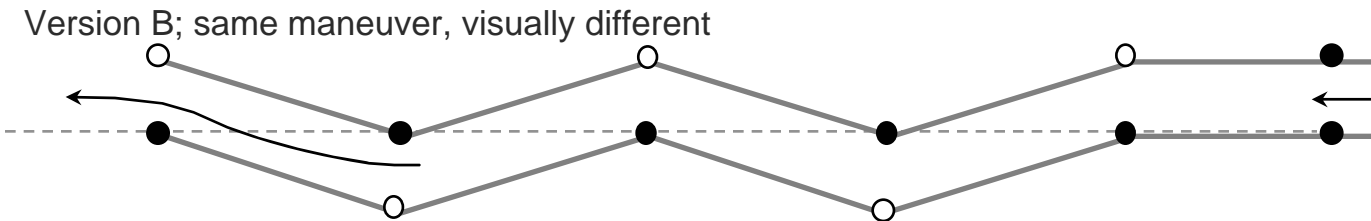
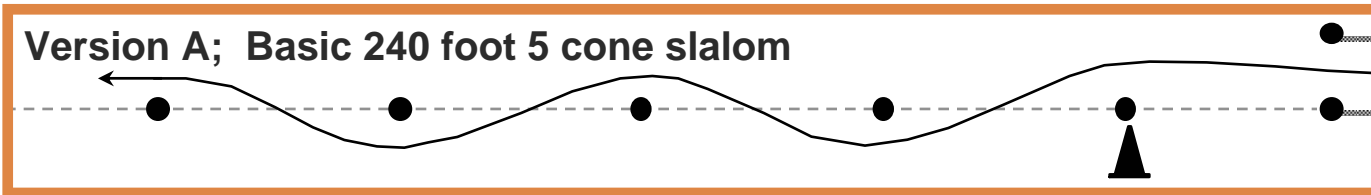
- Include turns of varying radii and speed
  - Sweepers should come in various sizes, possibly even with changing radii
  - Don't design a course consisting primarily of 180° turns.
    - use 90°, 180°, 60°, fast 45° turns, etc.
- Provide a variety of car path directions
  - Use the various turns to send the car in directions not always perpendicular or parallel/perpendicular to the site outside perimeter or the site markings on the surface such as paint stripes or concrete squares
- Provide a variety of transients
  - Straight slaloms / offset slaloms
  - Sequences of offset gates
  - Lane changes
  - Combinations of the above
    - Challenging courses include combinations of transients that require a precise proper entry into the first part of the combination in order to drive through the entire combination quickly

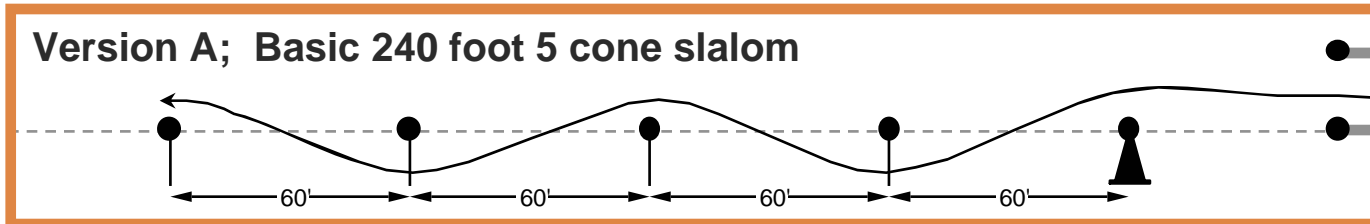


# Application of Creativity (continued)

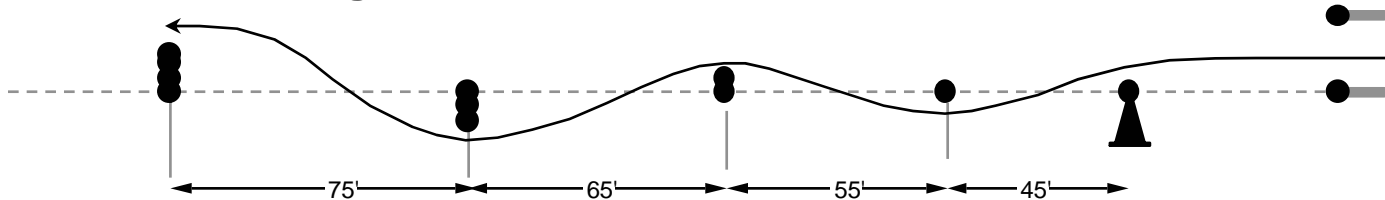
- Provide sufficient input density
  - Input density is a measure of direction-changing inputs which the driver must give to the car to negotiate the course divided by the length of the course - the following is only a guideline (nothing is “black and white”)
    - Good input density would have about **20 to 35** inputs over a distance of approximately 3/4 mile
    - A less interesting course will have only **15 to 20** inputs for the same distance
      - Results of too little input density
        - A boring, non-challenging course to drive, where all times run are approximately the same
    - If input density is **over 35** inputs for 3/4 mile, odds are that the design is too busy
      - Results of too great an input density
        - Drivers will never seem to have the time or room to set up for the next element
        - Drivers feel they are thrashing through the course, just trying to survive until the finish

# 5 Cone Slalom



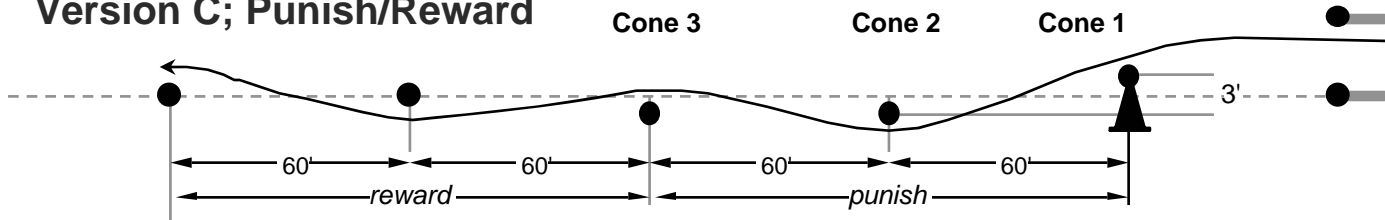


**Version B; Change for interest**



Note: Version A & B are both 240' long. Version B offsets one cone width for each gain of 10' in slalom length, resulting in a more interesting maneuver of the same nature. The increase in distance prevents the maneuver from becoming painful

**Version C; Punish/Reward**

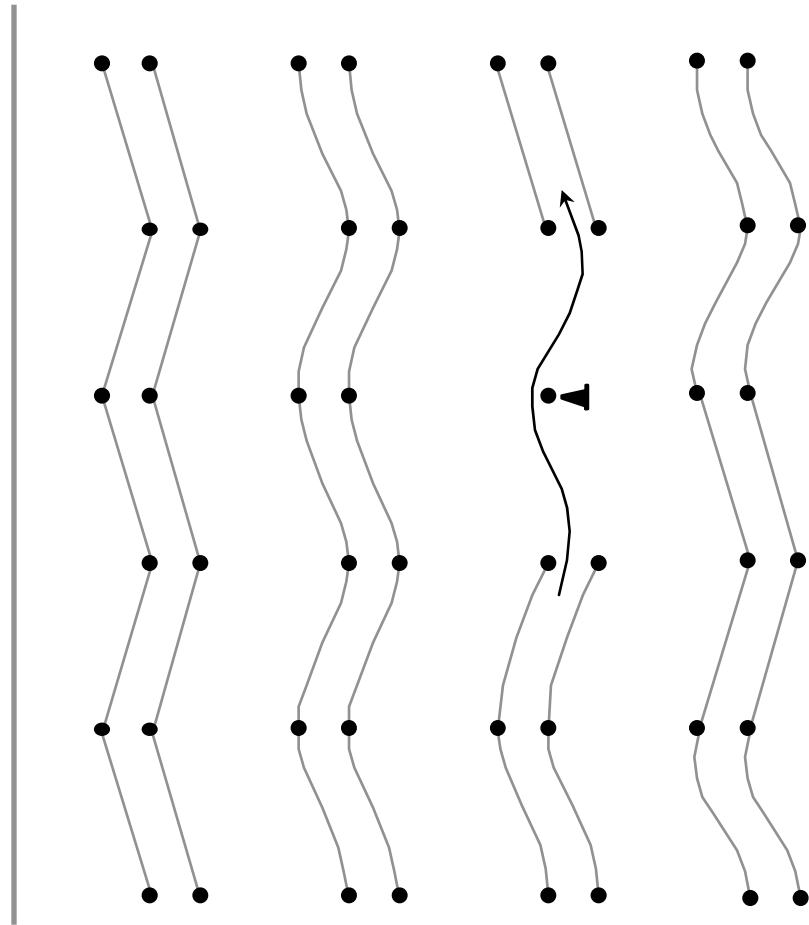
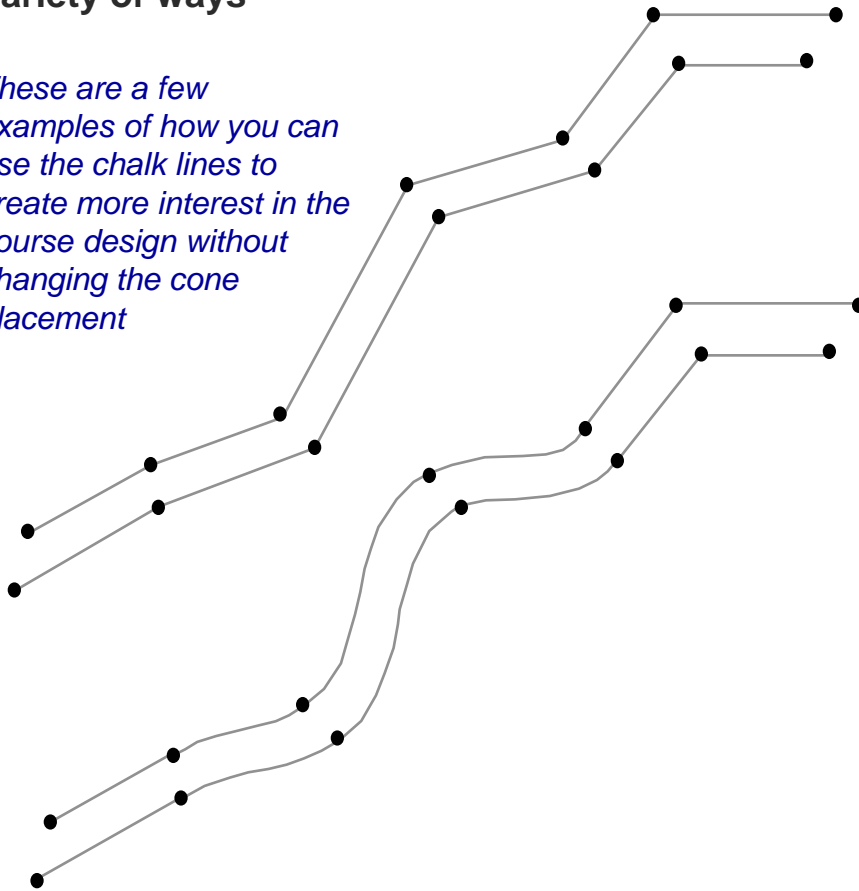


Note: Cones 1 & 2 are offset 3' the hard way with cone 3 offset 1.5' the easy way. This opens up a "Lotus freeway" through the last 3 cones of the slalom. To make the punishment bearable, be sure to allow adequate set up area prior to the punishment, otherwise the punishment becomes painful

# Chalk Lines

Use the chalk lines in variety of ways

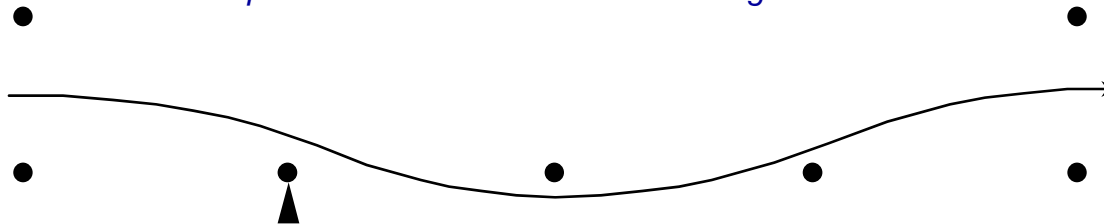
*These are a few examples of how you can use the chalk lines to create more interest in the course design without changing the cone placement*



Placement of the gate "before and after" the start and finish of a slalom is critical as to the amount of turns that the slalom actually becomes

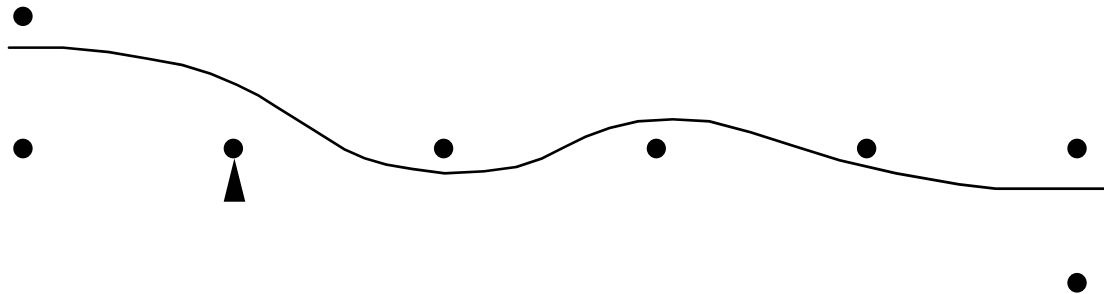
**3 Cone Slalom**

*The intent of a three cone slalom is usually to make 3 turns. As you can see from this example, this slalom has become 1 turn due to the placement of the "before and after" gates*



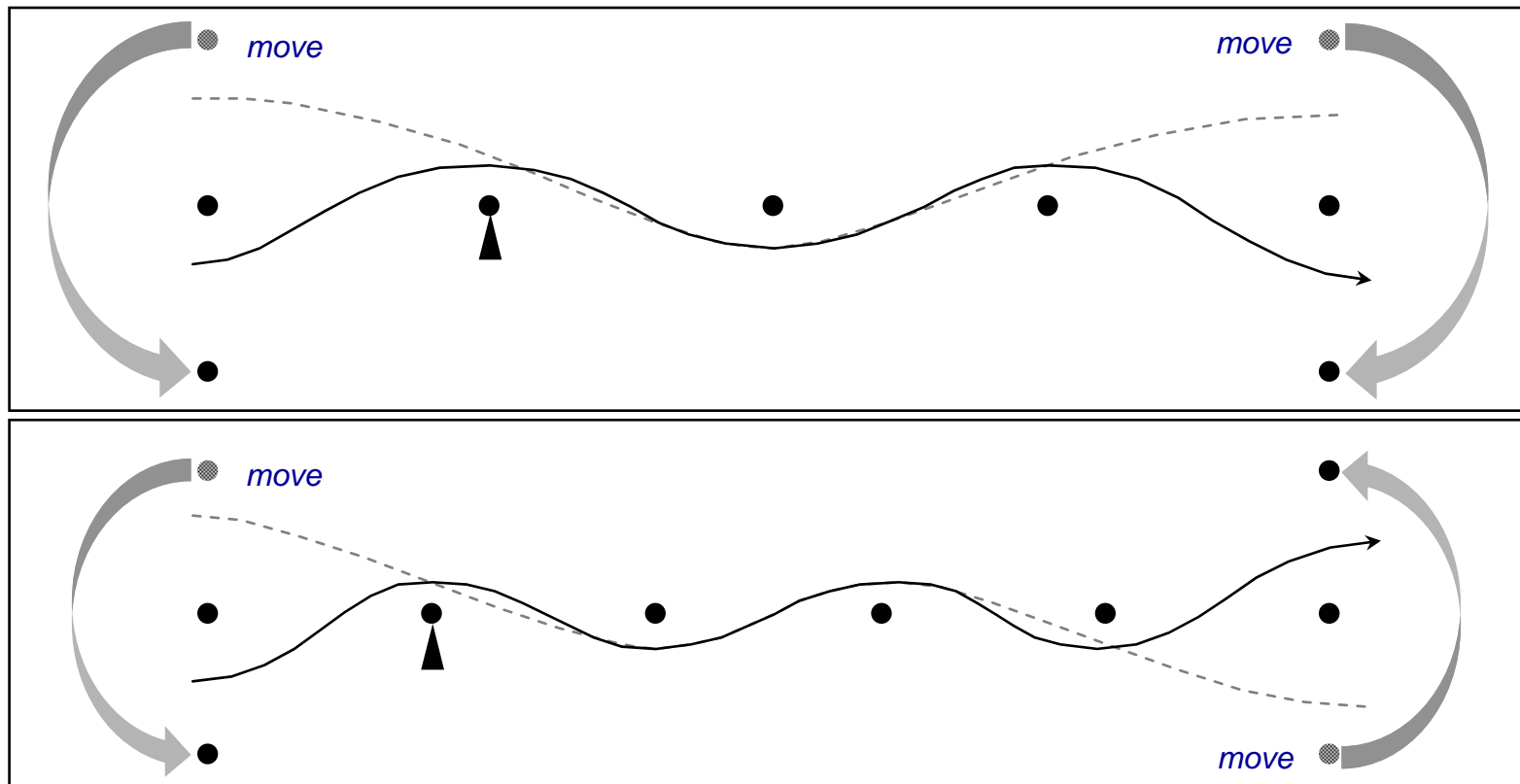
**4 Cone Slalom**

*The intent of a four cone slalom is usually to make 4 turns. As you can see from this example, this slalom has become 2 turns due to the placement of the "before and after" gates*



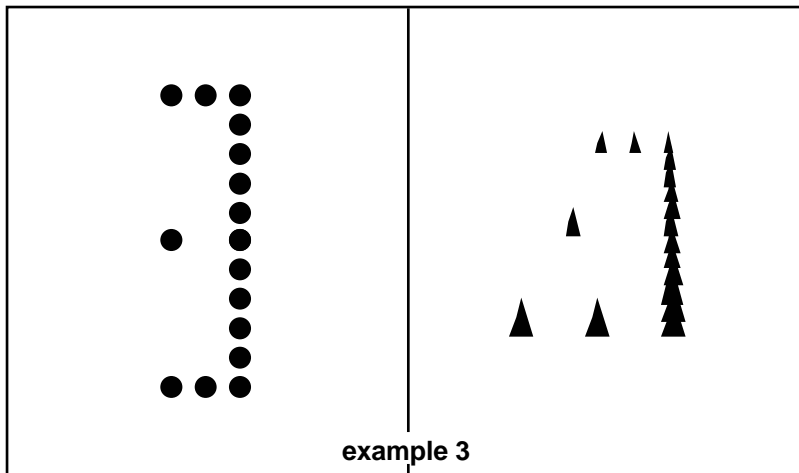
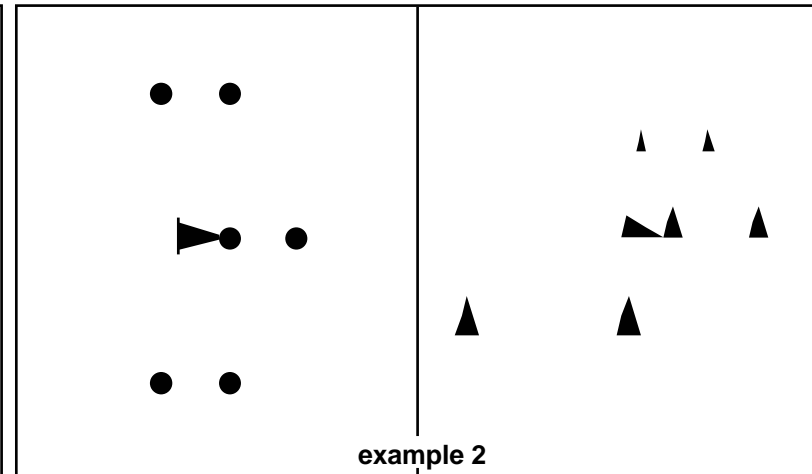
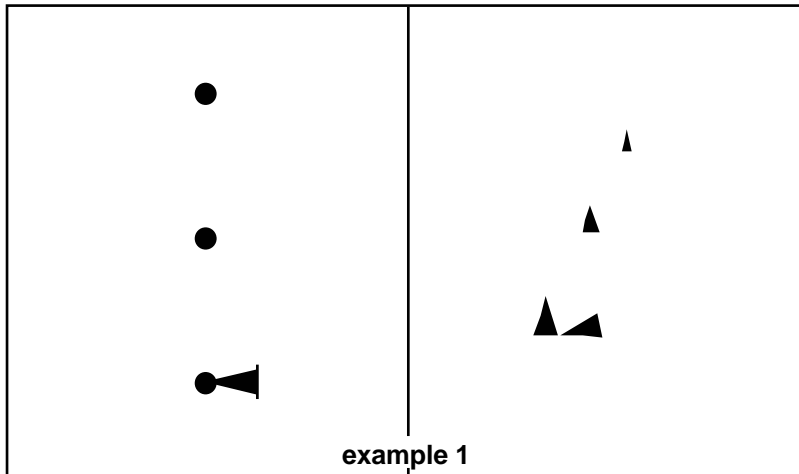
10 Basic Concepts - Use Creativity  
**Tweak the "Before and Afters"**  
at the Event Site

Note that the three cone slalom now has 3 turns and the Four cone slalom has 4 turns. By tweaking the placement of these two gates at the event site, you can increase/decrease the severity of a slalom just by moving either or both of these gates a few feet to get the flow you want.



10 Basic Concepts - Use Creativity  
 Which is easiest to see?

All three of these are a slalom - the same maneuver. Obviously, **example 1** is easiest to see.



You must also consider if the inclusion of your “creative” cone placement has reduced the clarity of the course significantly.

In this case, the surrounding cones from the following maneuvers may impact the clarity of these examples as well. For instance, if you have several walls of cones just following this slalom, example 1 would be most appropriate. If there were not, examples 2 or 3 might be appropriate.

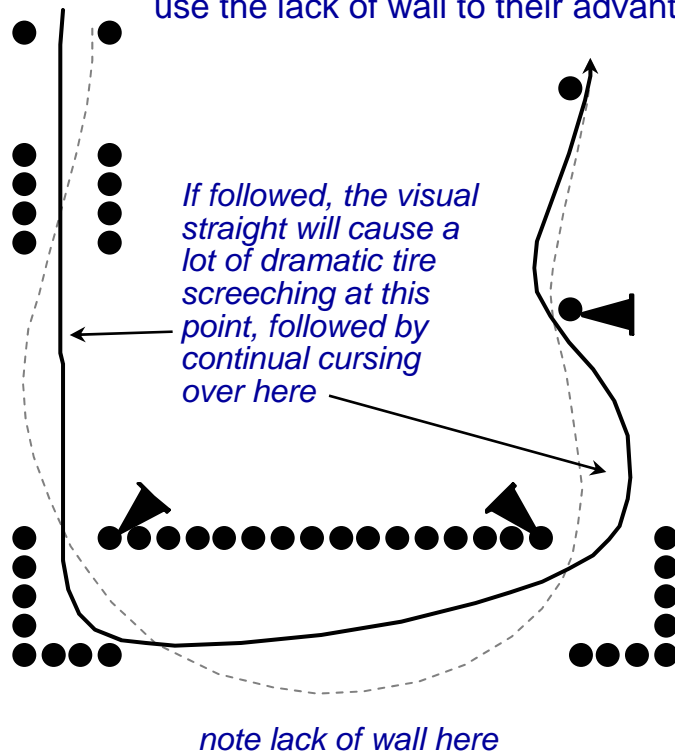


# The Brainer

the intent of a "brainer" is to allow a fast line through, but give it the visual effect of a slow maneuver. This will then give the competitor a reward, or a "doggy bone" if you prefer, for figuring it out.

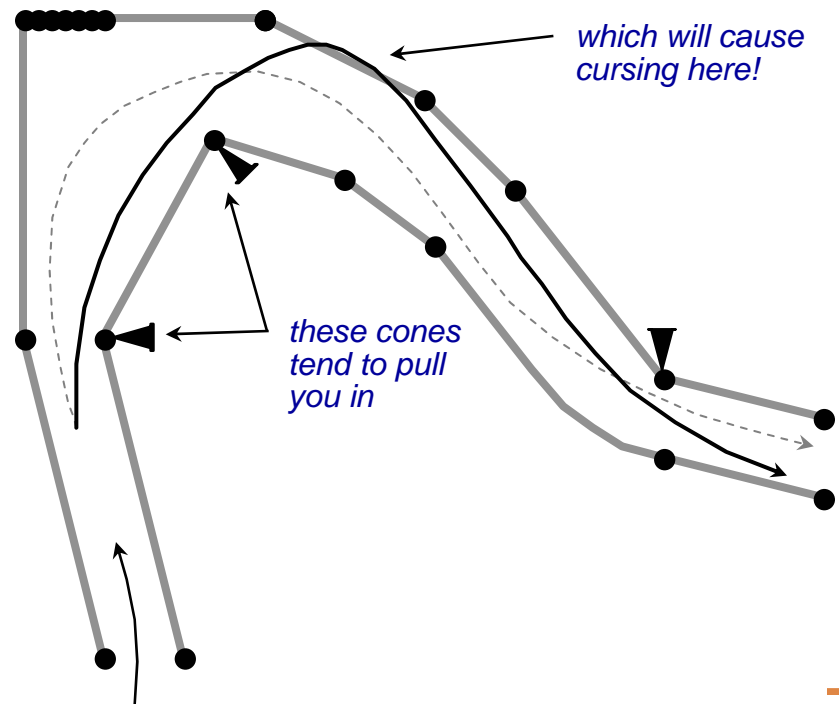
**The Brainer**

The wall at the 180° will tend to make an unwary competitor square the corner out. The driver who looks carefully will round the corner out and use the lack of wall to their advantage



**The Brainer**

Competitors that don't "read" the course tend to drive cone to cone. The indicated cone will tend to pull in a driver who has not thought this one out. The fast line is to stay wide to make a sweeping turn.



## 3.) No Hidden Agendas

- You should not accept a course design job for any reason other than a desire to design a course
  - If you are not really interested in the design of it, chances are that you will not create a good course
  - If you have gotten the responsibility 'by default' (i.e the responsibility comes with being Event Chairman), try to enlist someone who is truly interested in designing a course - you will still be ultimately responsible for the design, but will have "jobbed" it out to a more qualified/interested party
  - Avoid designing the course on the premise of favoring your car, while penalizing others
    - Example; Camaro versus Miata
      - Camaro: 1000' straight, 180° turn, and a 1000' straight
      - Miata: 45' offset slaloms connected with 30'Radius "sweepers"

With a hidden agenda the result is a course that only a few people enjoy - or perhaps even a course that **NO ONE** will enjoy!

## 4.) Be Familiar with the Solo II Course Design Rules

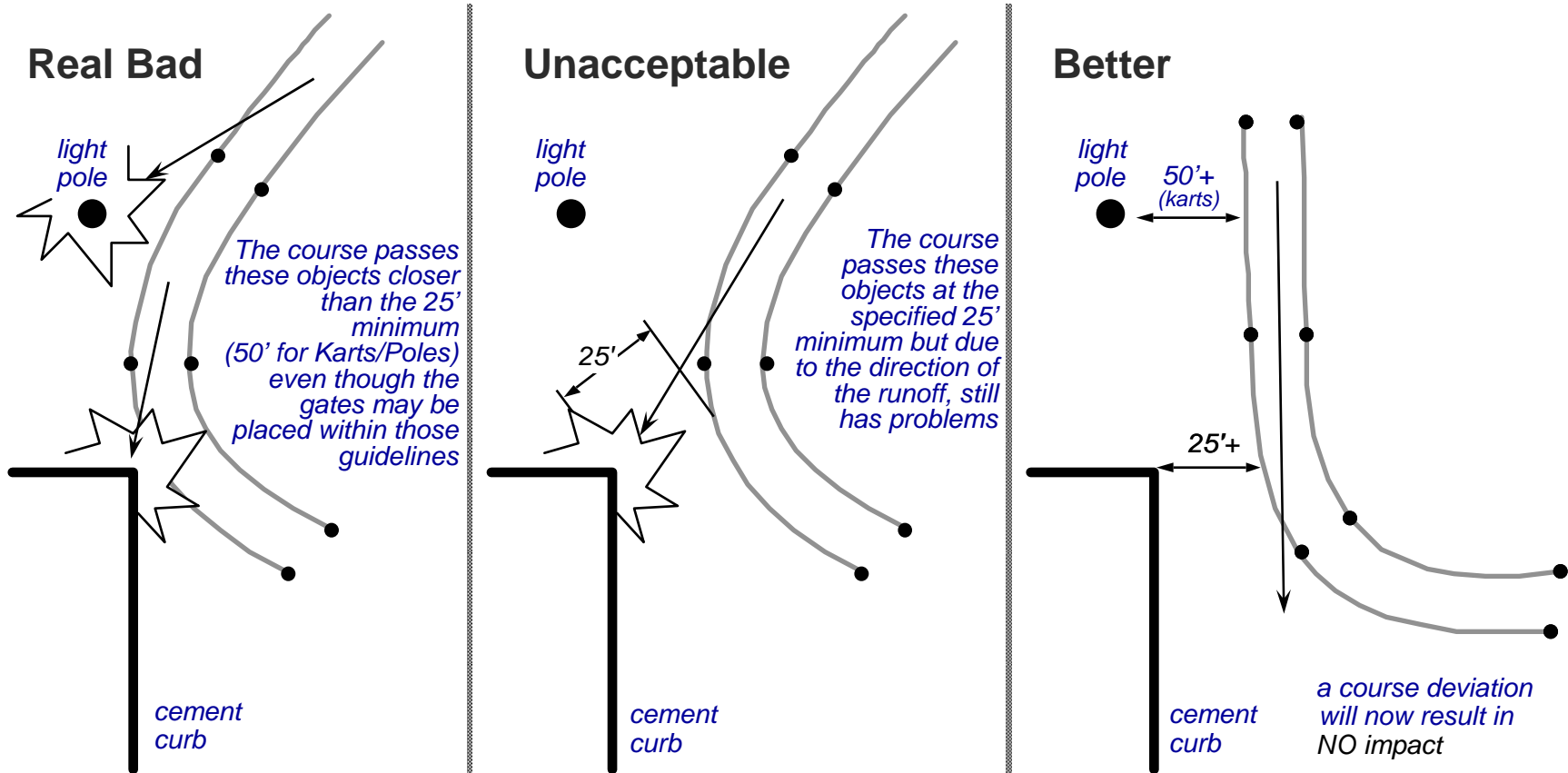
**Basic Concept 4.) deals with the Solo II Course Design Rules found in Section 2.0 of your Solo II rule book.**

- The obvious advantage to knowing the rules in Section 2.0 is that you will be more likely to create a design that will be considered a Solo II type course, as well as a course that is acceptable to the assigned Safety Stewards and your competing peers
- The following are diagrams taken from some of the 2003 rules
- ALL of the rules, of course, are important and should be known/understood - these are just the rules that I perceive to have the most impact on your design decisions

# 2.0 Diagrams

- 2.1.C The course boundary shall not normally pass closer than 25 feet from solid objects
- 2.1.D karts... ..upright solid objects on site within 50 feet of the course.  
 This does not include curbs

*The "better" example shown here is considered minimum. Greater distances from Stationary objects is always better*

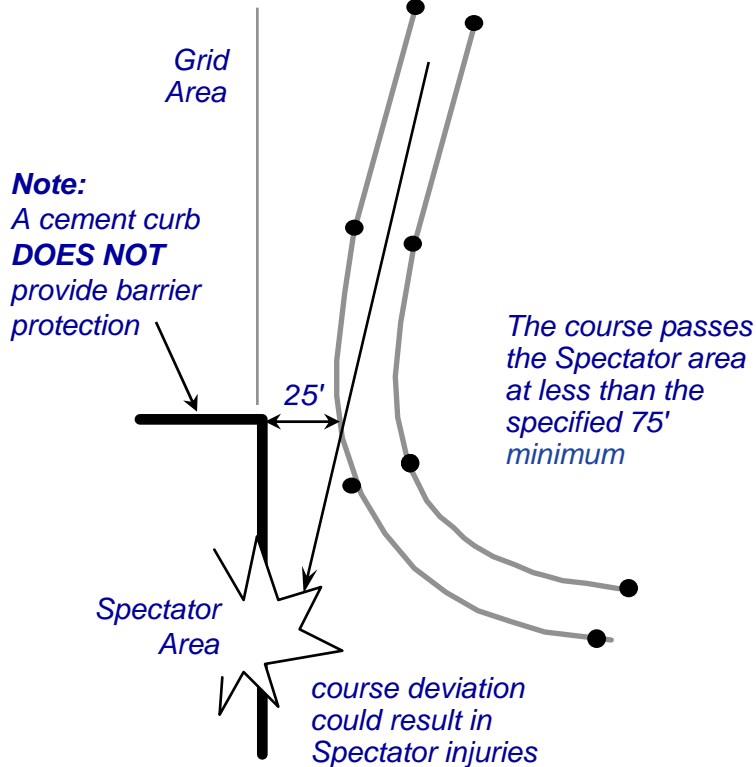


# 2.0 Diagrams (continued)

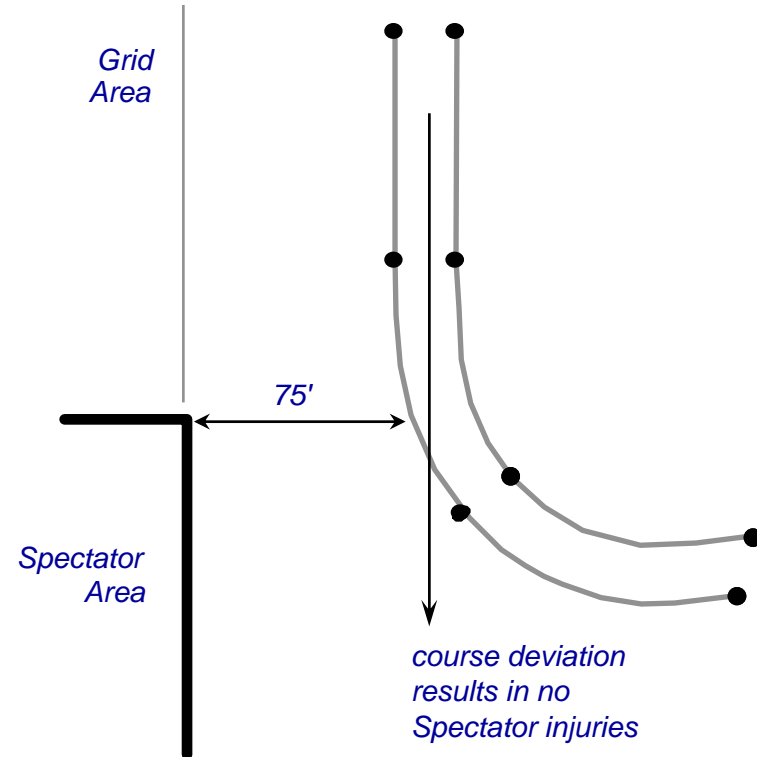
2.1.M Participants and non-participants must be kept at a safe distance... ..minimum viewing distances may not be less than 75' from the course edge in unprotected areas (areas without adequate barrier protection such as concrete or tire walls)...

*The preferred example shown here is considered minimum. Greater distances from Spectator Areas are always better. Fast course sections should never aim directly at spectator areas without very large runoff distances*

## Incorrect



## O.K.



# 2.0 Diagrams (continued)

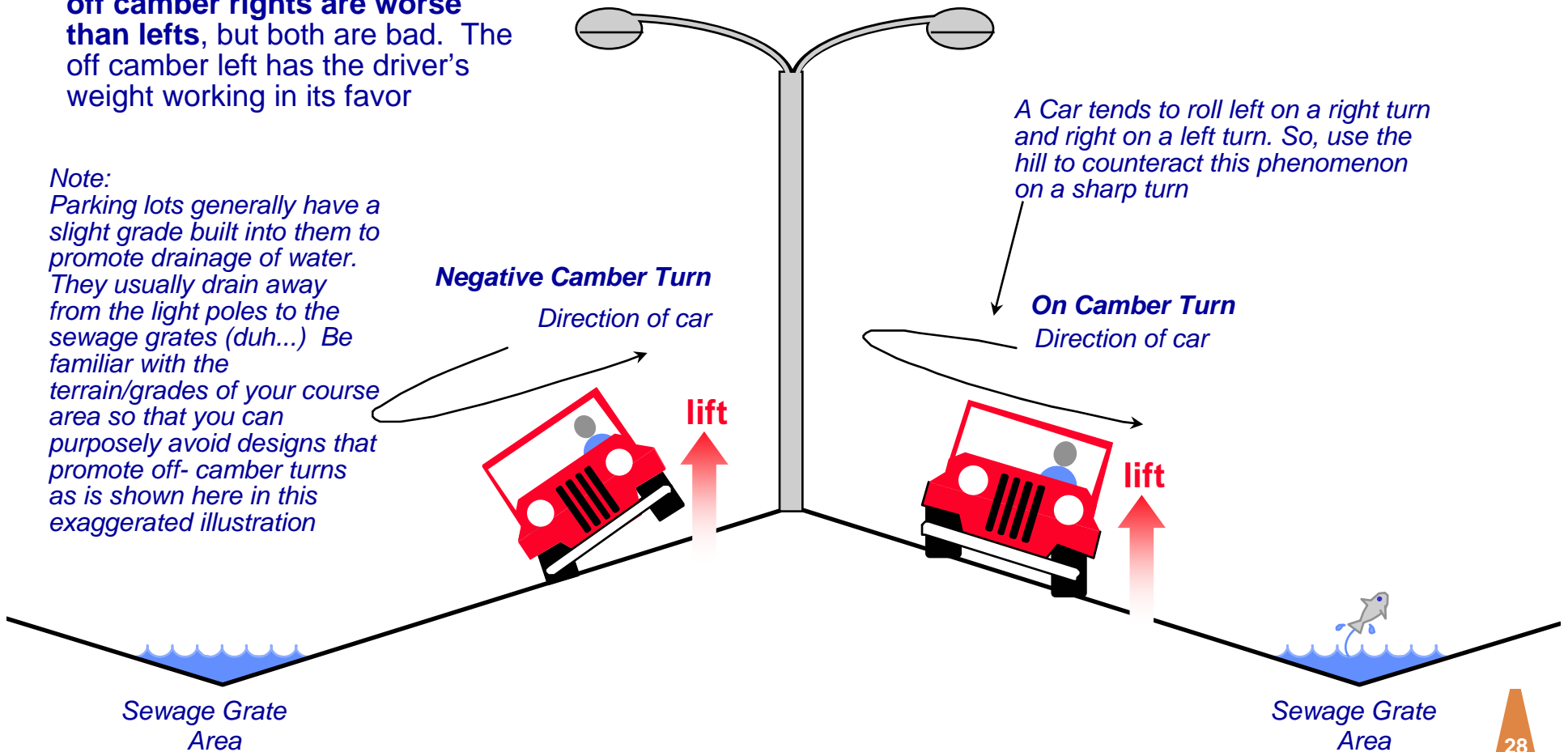
## 2.1.E Negative cambered turns will be avoided if at all possible

Note:

**off camber rights are worse than lefts**, but both are bad. The off camber left has the driver's weight working in its favor

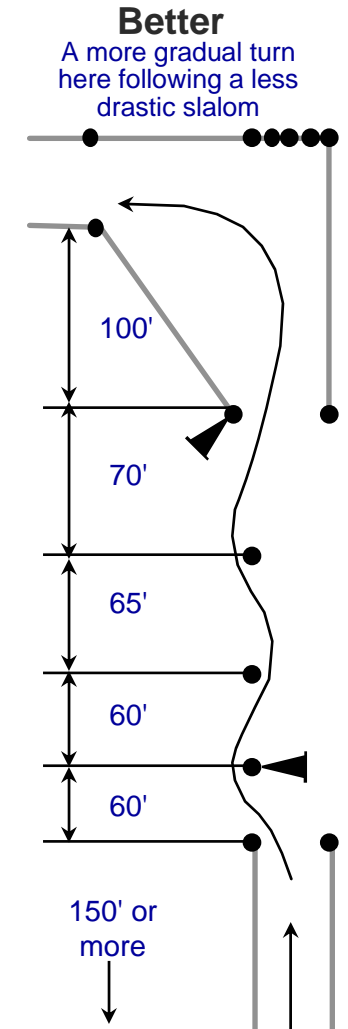
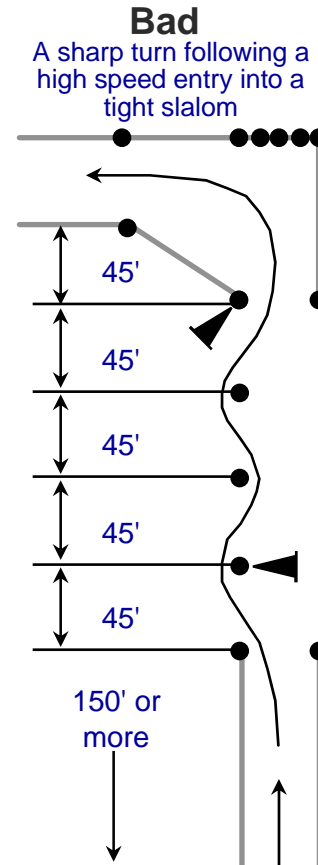
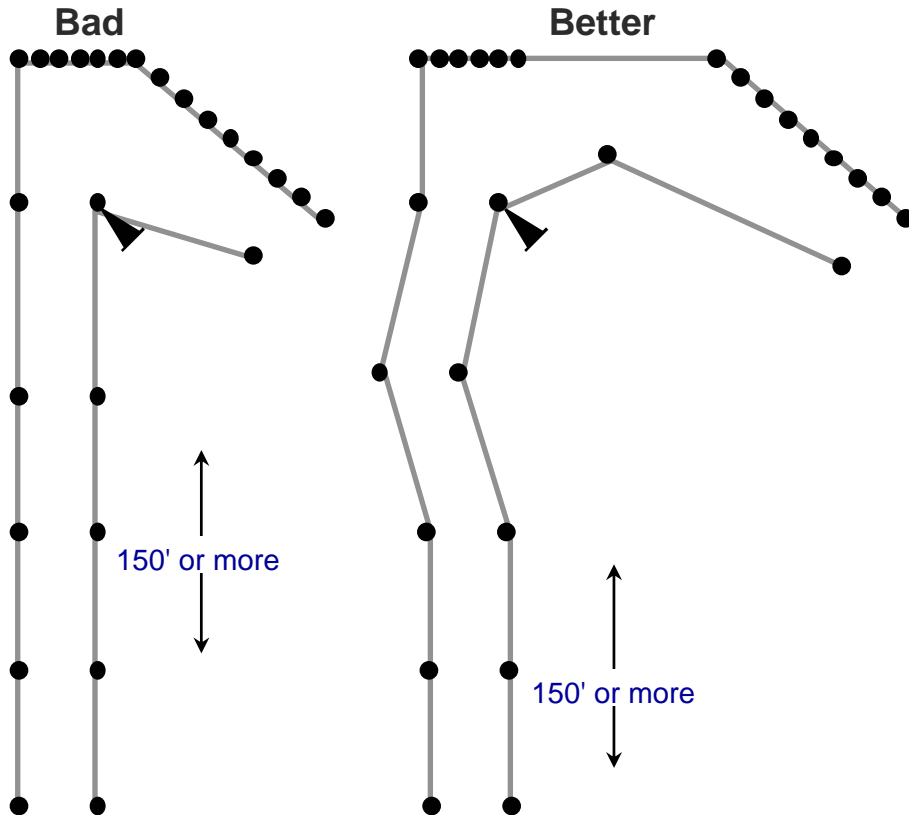
Note:

Parking lots generally have a slight grade built into them to promote drainage of water. They usually drain away from the light poles to the sewage grates (duh...) Be familiar with the terrain/grades of your course area so that you can purposely avoid designs that promote off-camber turns as is shown here in this exaggerated illustration



# 2.0 Diagrams (continued)

2.1.F A long straight (over 150') should not terminate in an extremely sharp turn...



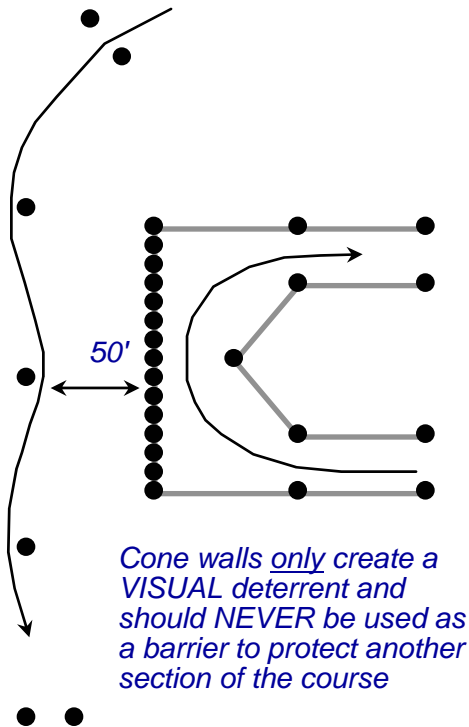


## 2.0 Diagrams (continued)

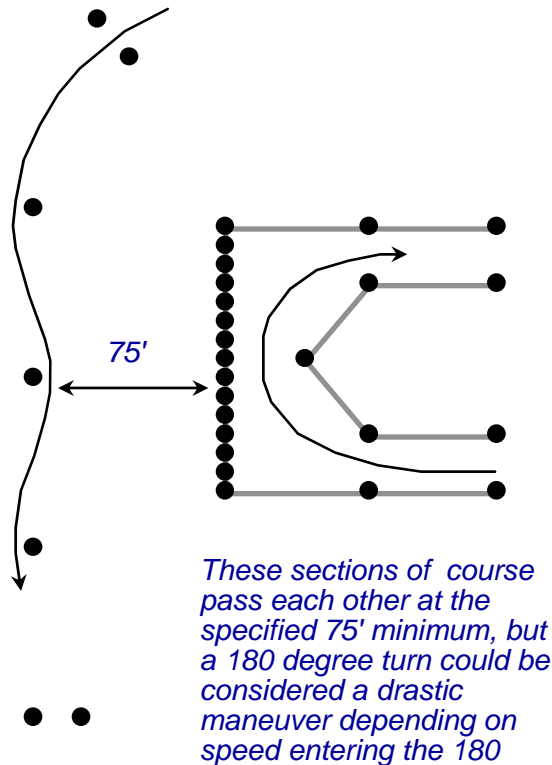
### 2.1.H Cars on course simultaneously shall not run in close proximity to each other

*"Close Proximity"... The definition of this is ultimately up to the Safety Steward, but if you consider rule 2.1.L, the absolute minimum would be 75'. Obviously, the more drastic the maneuver, the more space that should be allotted. The whole idea of this rule is to keep 2 competitors from colliding in the event of one (or both) of them losing control or getting lost on course.*

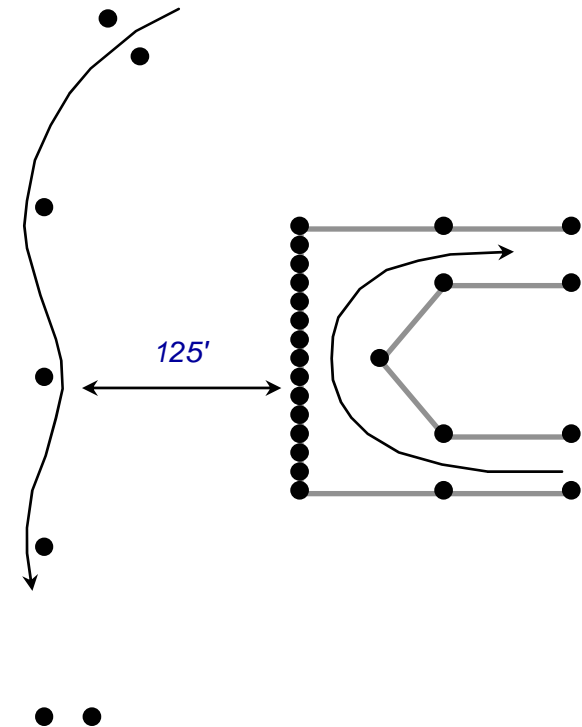
#### Unacceptable



#### Acceptable



#### Better Yet



## 5.) Make the Course Flow

**“There’s no such thing as a car that can turn on a dime...”** *K. C. Babb*

- It’s not necessary to get into third gear in order to have a fun course
  - The level of “fun” will more likely be determined by the flow of the course instead of the highest attained speed
  - If you feel like you’ve gone fast without violating the speed paradigms, then your design is a success
- So, then what is the “Flow of the Course”?
  - The flow generally refers to the manner adjacent sections of a course connect to each other.
  - Envision a river flowing down a riverbed. Even when the water is moving rapidly and encounters an object, it will find a way to flow around the object smoothly. Your course should have the same characteristics. If a car cannot be maneuvered through the obstacles smoothly, the course does not flow.

10 Basic Concepts - Make the Course Flow  
**Ways to Make  
Your Course Flow**

- Visit the site before submittal of your map to make your map accurate and to include things and land formations to avoid
- To be able to accurately determine the flow of a course before you set it up, you must be able to first **draw a scale map** (gasp!). From this map, you will then be able to apply the following suggestions on paper
- Locate the “key cones” in your design (*see diagram on page 35*)
  - These are the cones that determine the actual path of the car
    - If it **is** a key cone, its removal would change the path of the vehicle running the course
    - If it **is not** a key cone, the removal of that cone would not change the path of the vehicle, but could confuse the driver...
    - There is a common misconception that the wider the gate, the faster the course. This is not necessarily so. Since the key cones determine the path of the vehicle, the gate width becomes a secondary limiting factor (*see diagram on page 36*)
  - Once the key cones have been identified, look to see if varying gate width or key cone placement can be used to aid in the flow of the course

# Ways to Make Your Course Flow

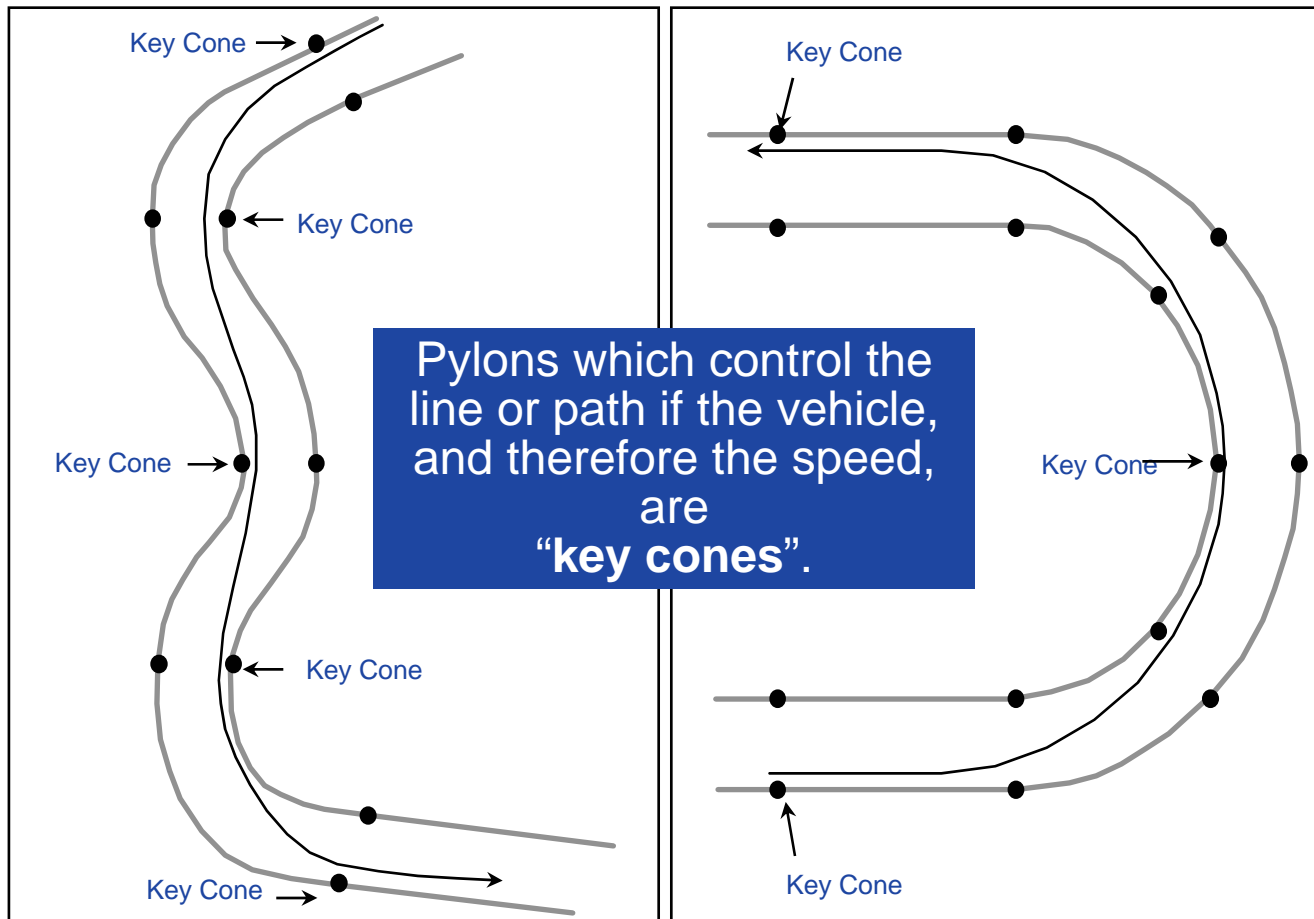
(continued)

- Determine which cones control the speed and direction of the course (key cones) and remove any of the remaining cones that could cause confusion  
*(see diagram on page 35)*
- Remove a slalom cone in a 45' - 55' slalom *(see diagram on page 37)*
- Allow a few more feet of width and/or length when approaching the next maneuver *(see diagram on page 38)*
- Avoid painful walled-in turns *(see diagram on page 39)*
- Ensure the “next gate” is visible in your peripheral line of sight  
*(see diagram on page 40)*
- Move a limiting or constricting gate 1 to 10 feet left or right to open the approach up. Be careful; movement as little as 1 foot can make more of a difference than you might imagine. The approach from the previous maneuver and/or the exit to the next maneuver will determine the impact of this move.
- Do not use *painful* maneuvers to slow things down *(see diagrams on pages 29, 41 and 42)*
  - A 300' straight into a 45' slalom **IS** painful - shorten the straight or lengthen the slalom
  - Allow a minimum of a 45' Radius in your turns  
*(most cars have a ~20' minimum turning radius)*
  - Allow the driver ample room to choose a favorable line
  - No lock-to-lock turns

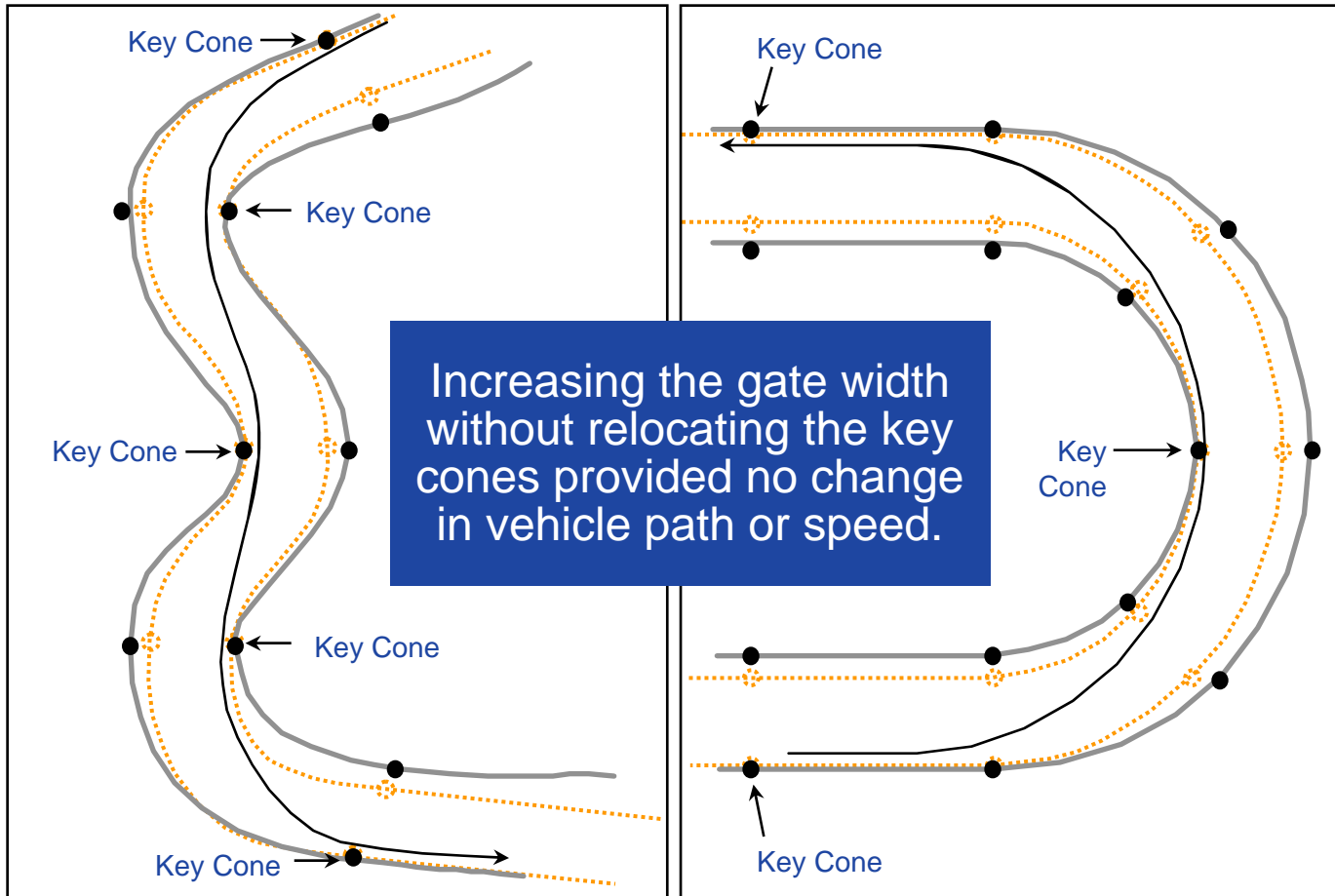
## 10 Basic Concepts - Make the Course Flow

# Maneuvers to Avoid

- Avoid maneuvers that could make a car roll (*see diagrams on pages 28 and 29*)
  - Don't use significantly off camber turns, especially right turns
  - Don't use decreasing radius right turns - especially sharp ones
  - Avoid "one-two" hard corrections following a fast section as can be found in a decreasing slalom
- There are also a few "No Fun Maneuvers" (NFM) that I would recommend avoiding if possible
  - Any maneuver that requires a 1st gear down shift
  - 360 degree pivot turns - or also known as a spin cone
  - Narrow, walled in sharp turns
  - Gates or Slaloms with severe offsets and short spacing (45' spacing; 10' offset)
  - Two 90 degree walled in turns (shaped like a "Z") just before the finish lights (which is O.K. for a start - but no way to finish!)
  - Hitting the brakes hard just before the lights



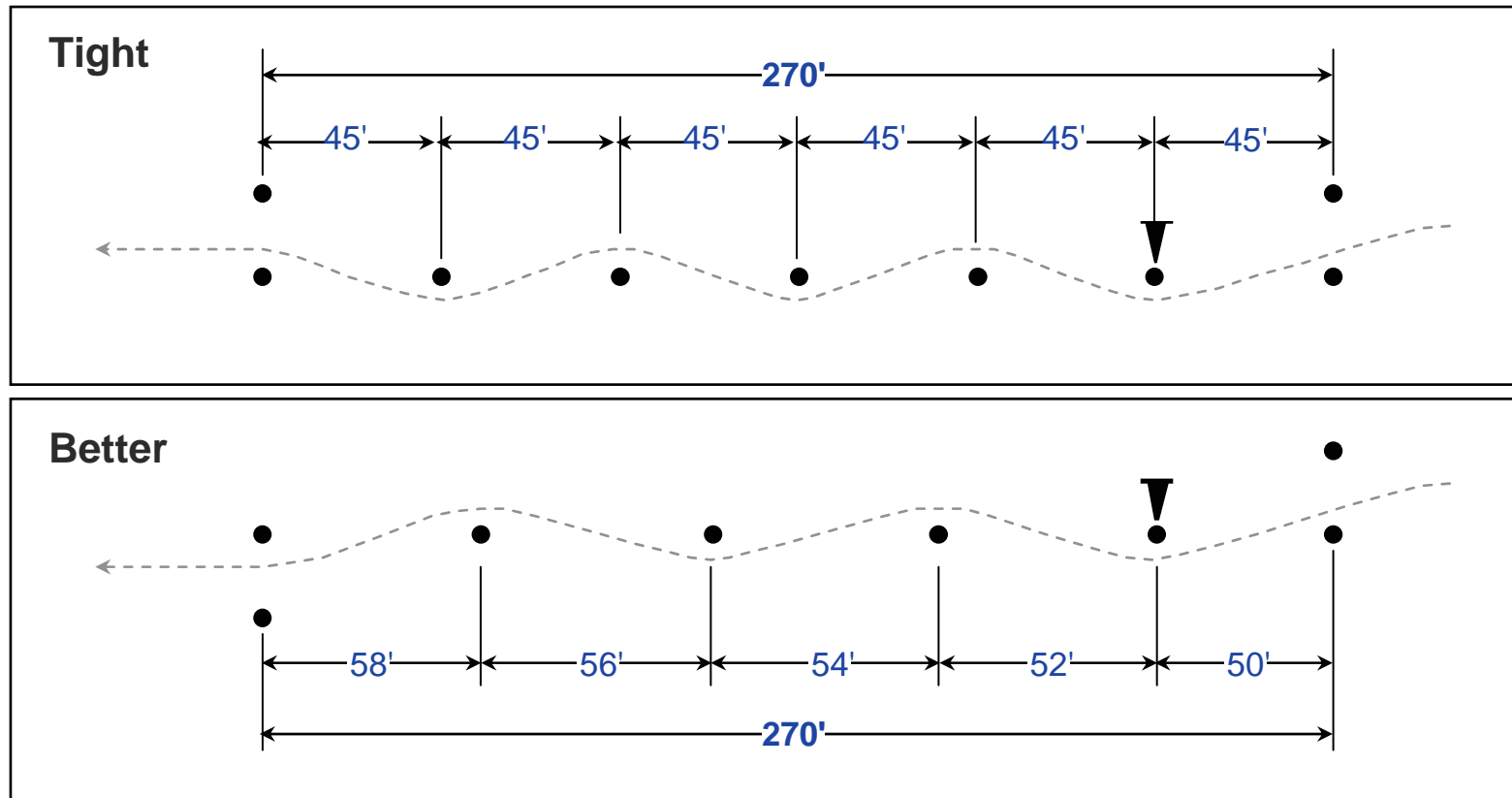
10 Basic Concepts - Make the Course Flow  
**Gate Width versus Speed**



**Advantages of wider gates**

- Choosing the **superior line** requires more skill and experience
- **Allows** for mistakes/sloppiness with **no pylon** penalties
- **Easier** on course **workers** and timing & scoring

# Remove a Slalom Cone

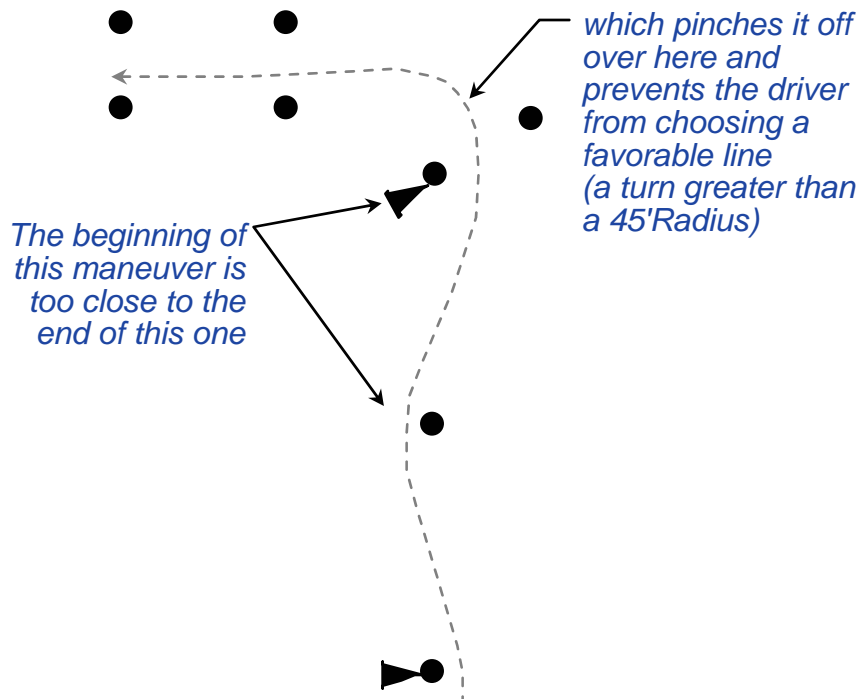


- By removing only one cone in this 270 foot slalom, you are able to open up the slalom to a more reasonable spacing of 54 feet. This is not a “wide open” slalom and definitely flows better than the example on top. You can also make the slalom a gradually increasing allowing the more astute course walkers the chance to pick up on a feature that not everyone will realize

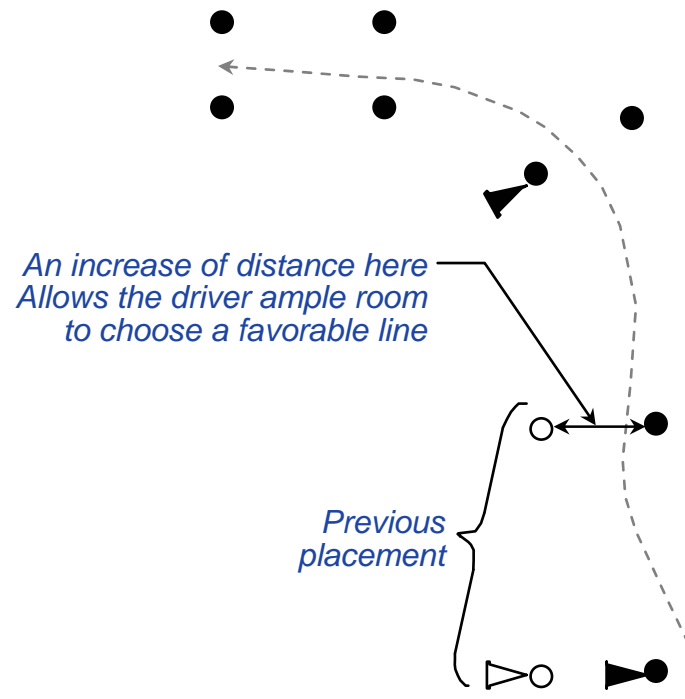


10 Basic Concepts - Make the Course Flow  
 Allow Room for Set Up

- Allow a minimum of a 45' Radius in your turns
- Allow the driver ample room to choose a favorable line



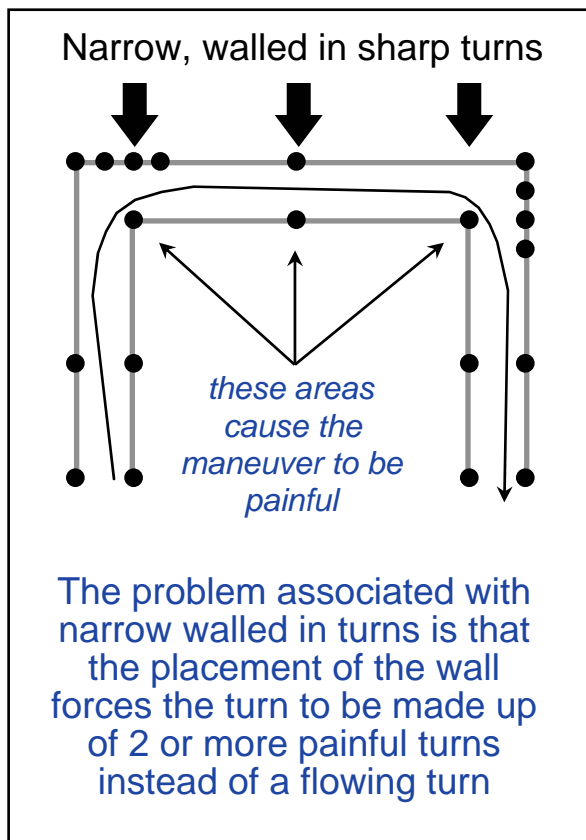
Below is an example of what I believe to be a better solution with the same "flavor" as the original idea



**Note:**  
 There are usually a variety of ways to accomplish this effect. In this case, moving the last 2 gates farther up and leaving the slalom where it was placed originally would have worked as well.

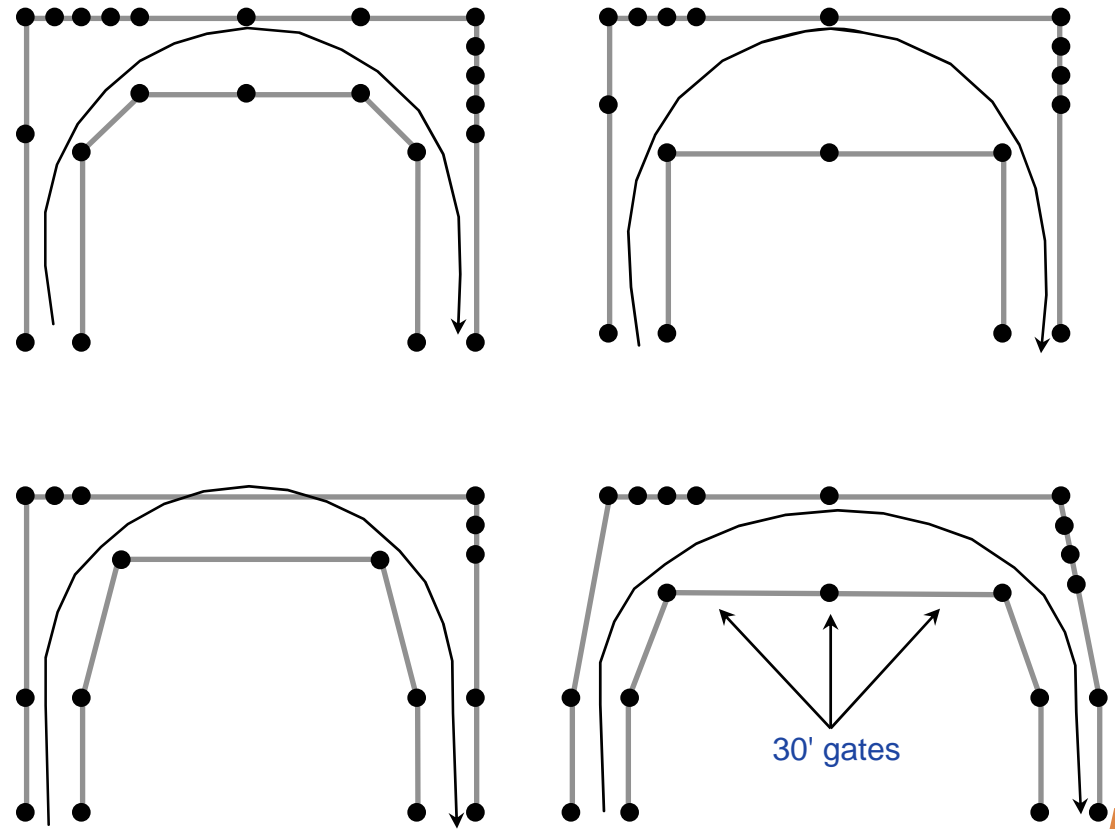
# Avoid "Painful" Walled in Turns

## Painful



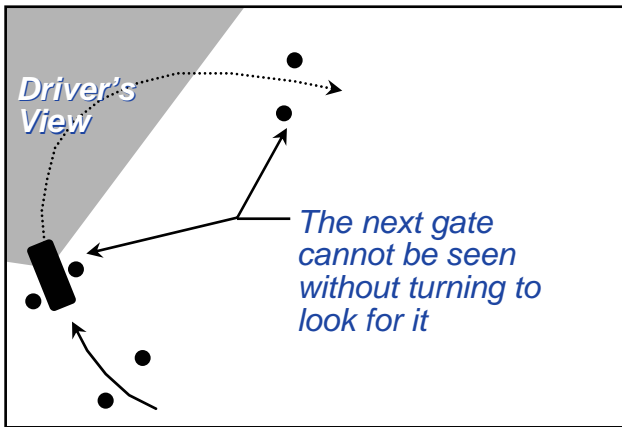
## Better

*solutions keeping the same flavor as the original*

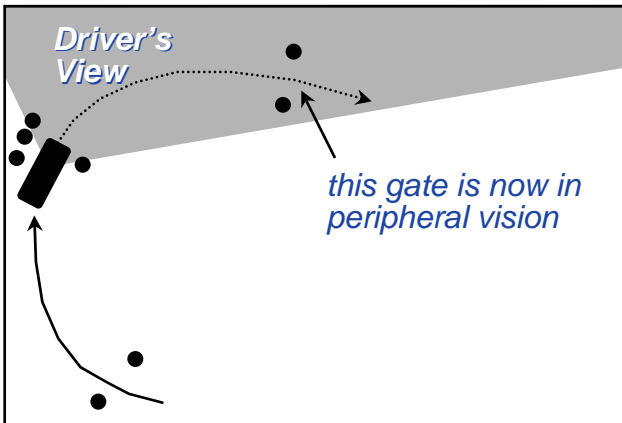


# Line of Sight and Gate Positioning

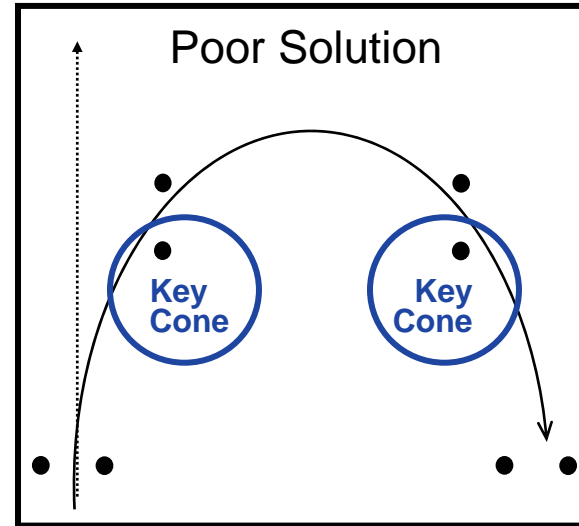
**Bad**



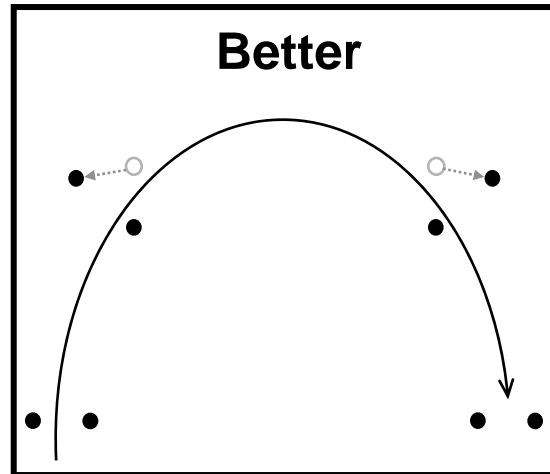
**Better**



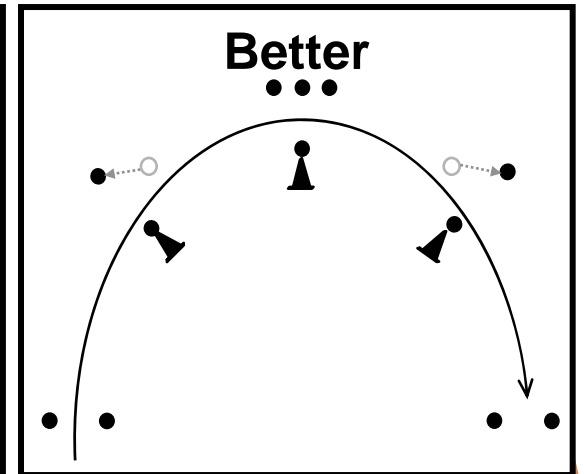
**Poor Solution**



**Better**

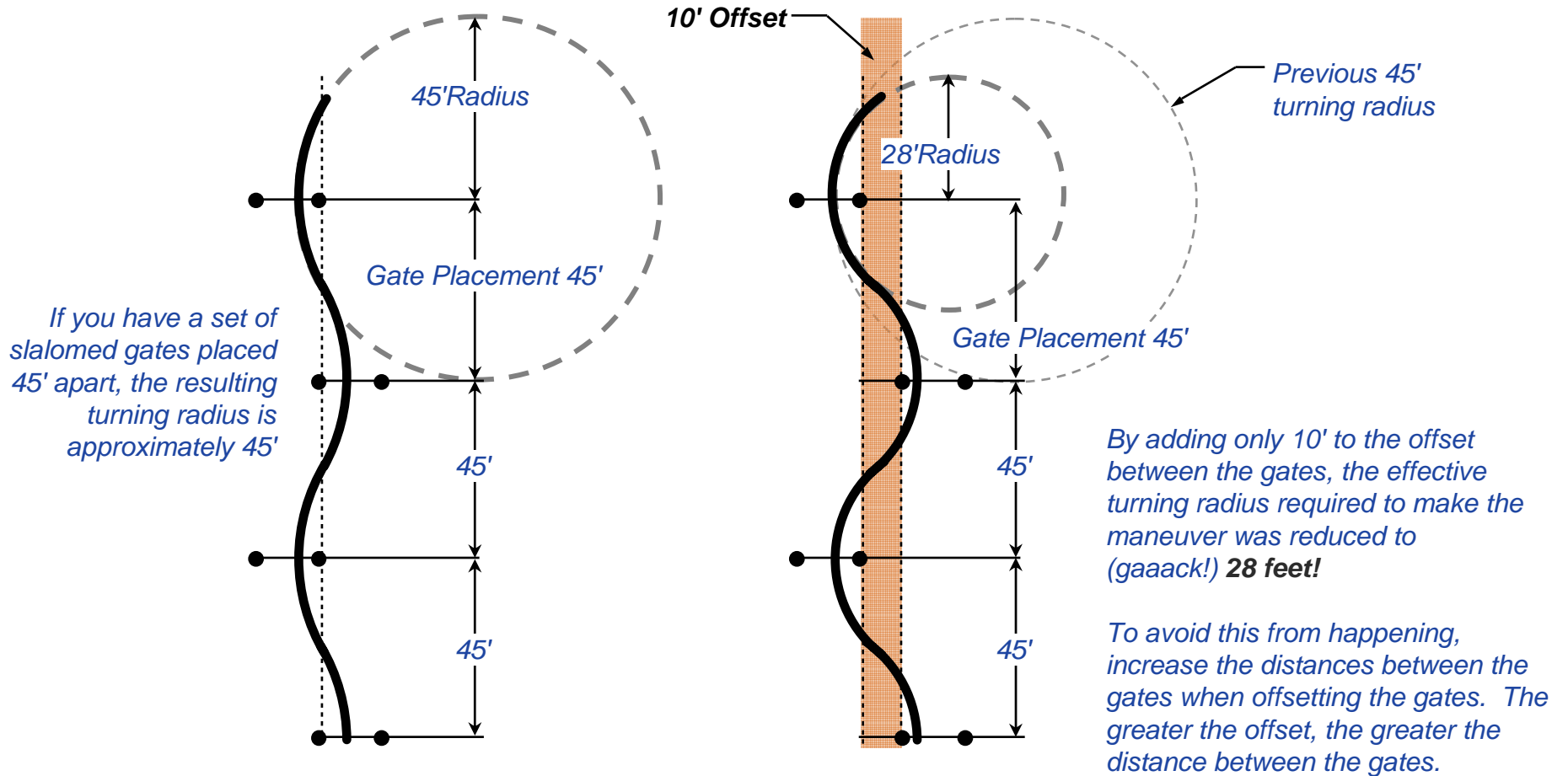


**Better**



# Lock to Lock Turns

## No lock to lock turns



# Lock to Lock Turns (continued)

**not fun**

*Too much lock to lock steering input required*

**painful**

*Generally, avoid 180° turns. The shape of some lots require a 180° turn, however, so don't make them painful with lock to lock steering inputs just before entering the 180*

**better**

*Same driving skills tested with less torture (less torture is a good thing...)*

**better**

- Open up the entering maneuvers
- Allow plenty of setup room to enter a 180° turn. Align your entry/exit gate centered to the 180 cone, unless you have allowed extra of room for your entry/exit of the 180

## 6.) Use Elements that Favor HP and Elements that Favor Handling

- The reason for using both types of elements is to create an “equalizer” course. This would be one where a 2nd generation Rx7T would have no advantage over a Camaro SS, which in 2004 were found in the same class (BS)
- By doing so, you will have a much greater chance of pleasing the majority of the drivers in attendance
- The first thing to decide is what favors horsepower and what favors handling. You then can evenly apply those kinds of maneuvers in your design.
- In a over simplified explanation:

### horsepower

straights (duh...)  
large radius sweeping turns  
sharp turns (90 degree or more)  
maneuvers connected with straights  
open maneuvers  
etc.

### handling

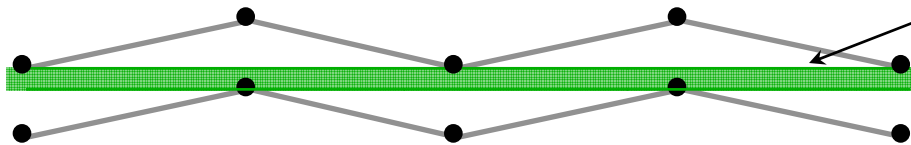
short to medium spaced slaloms  
small radius sweeping turns  
chicane/lane changes  
successive maneuvers  
tight maneuvers  
etc.

- A straight is any area where full acceleration can be utilized, and is not necessarily the classic definition of the shortest distance between two points
  - A slalom spaced greater than 100’ can be considered a straight

# Utilize "the Gap" to Help Control Speed

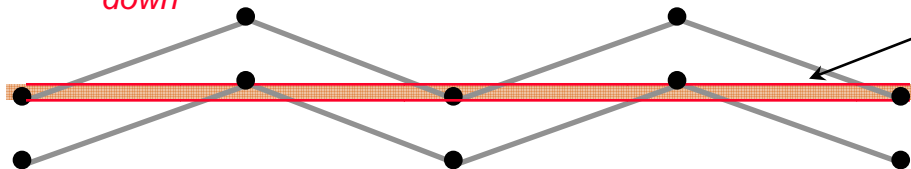
Use either easy or difficult maneuvers to speed up or slow down a course without disrupting the flow.

**Version "A"**  
*Speed things up*



By increasing this gap, you will effectively increase the speed of the maneuver. A small increase (e.g. one foot) will have a surprisingly large effect

**Version "B"**  
*Slowing things down*



By increasing this overlap, you will effectively decrease the speed of the maneuver. A small increase here will also have a surprisingly large effect

As was mentioned earlier, it is very important to draw scale map. This enables you to figure out where the fast/slow parts really are. Otherwise your course design will just be a fantasy in your mind until the day of the event. Placing it on paper allows you the freedom to actually design your course rather than depending on luck or chance.

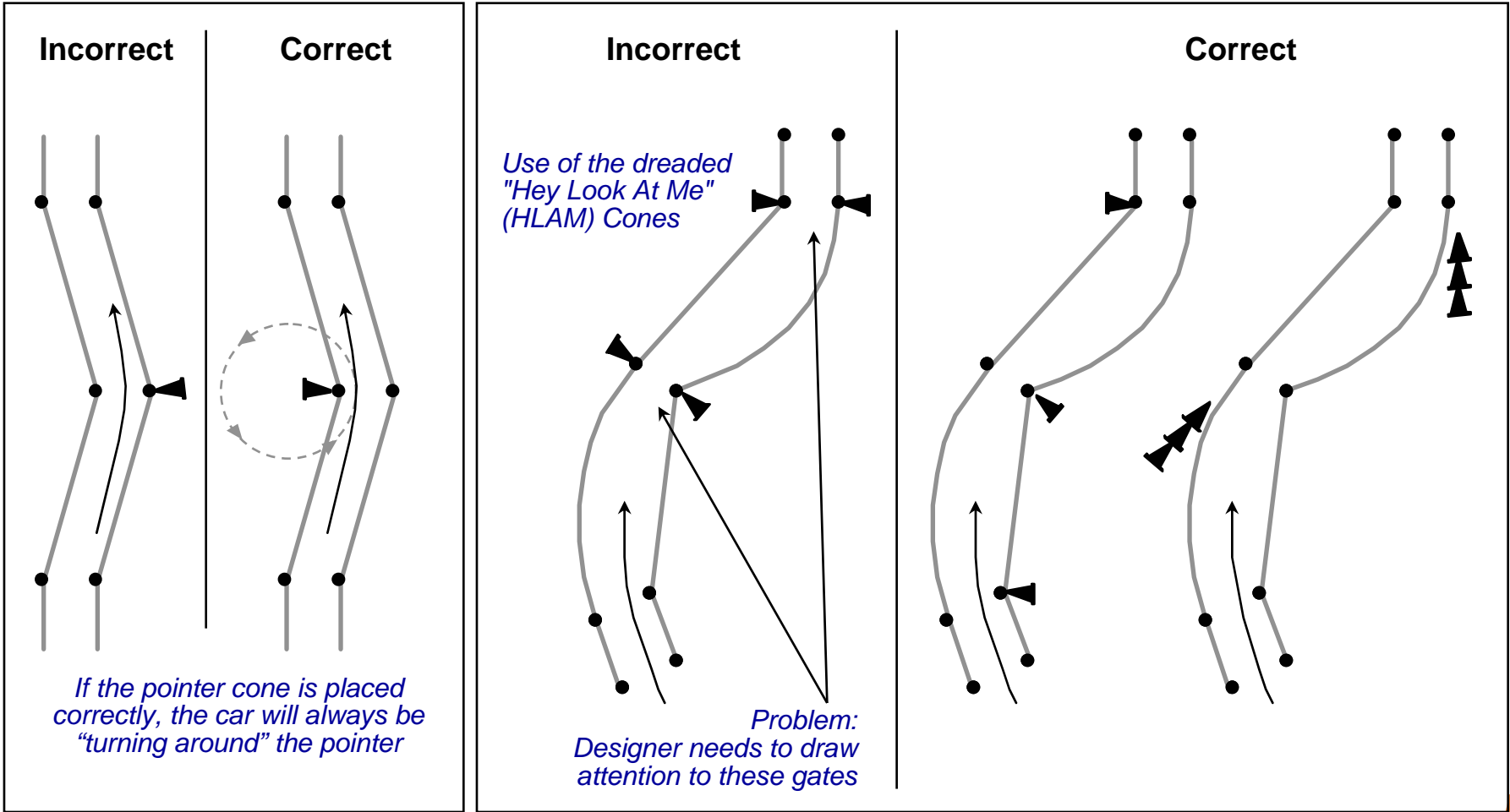
## 7.) Use Pointers and Directionals Correctly and Sparingly

- Pointers
  - A single lay down cone at the base of a standing cone
    - The purpose of a pointer cone is ONLY to indicate the inside of a turn (usually near the apex) - use them sparingly
    - Your car will always turn around a pointer when you negotiate the course if it is placed correctly
    - Do not use "Hey-Look At Me" (HLAM) cones - pointer cones on both sides of a gate (see diagram on page 46)
      - These can be confused with a down cone that a worker has not noticed
      - HLAM cones can make an experienced driver turn the wrong way since pointer cones are supposed to be on the inside of a turn
- Directionals
  - A series of lay down cones (3 or more) to guide the driver's to the left or right
    - The "big secret" to effective use of these is choosing a set number of cones (such as 3) and always use that amount when placing directionals on the course
    - This creates a recognizable pattern anytime a driver sees 3 lay down cones, telling them that it is a directional set and not some cones the course workers missed while telling a good joke

With pointers and directionals, "less is more"



10 Basic Concepts - those damn pointers...  
**Correct Use of Directionals and  
 Pointers Cones**



## 8.) Line the Course

*Note: If the site prohibits the lining of a course, please skip to rule 9. If your course is at a location that does allow course lining, please read on.*

- Line the course whenever possible because it makes it much easier for the inexperienced driver to make it through the course with out a DNF
- The course should NOT be line dependent
  - If it rains the course must still be able to be seen and negotiated successfully if all of the lines are washed away
  - This is accomplished by paying close attention to basic concept #5
- The lining of the course is intended to be a visual aid in basic course negotiation and not an indication of the correct line to drive
  - Care should be taken to avoid the “correct line” from passing over the chalk lines; and should this not be considered, “open wheel” drivers will complain - rightfully so!
  - Lines should not be so far outside the cones as to fall outside of the driver’s easy field of vision; 1 foot or less is a good guideline to use when lining outside of the cones
- What to use (in order of preference)
  - Flour: non-caustic, easy to get, bright on pavement, smells like a Bakery!
  - Marble Dust: non-caustic, hard to get, not bright on pavement
  - Fertilizer: Caustic, easy to get, not bright on pavement, promotes weed growth in cracks
  - Lime: Extremely caustic, Easy to buy, bright on pavement

## 9.) Place Gates to Avoid Visual Confusion

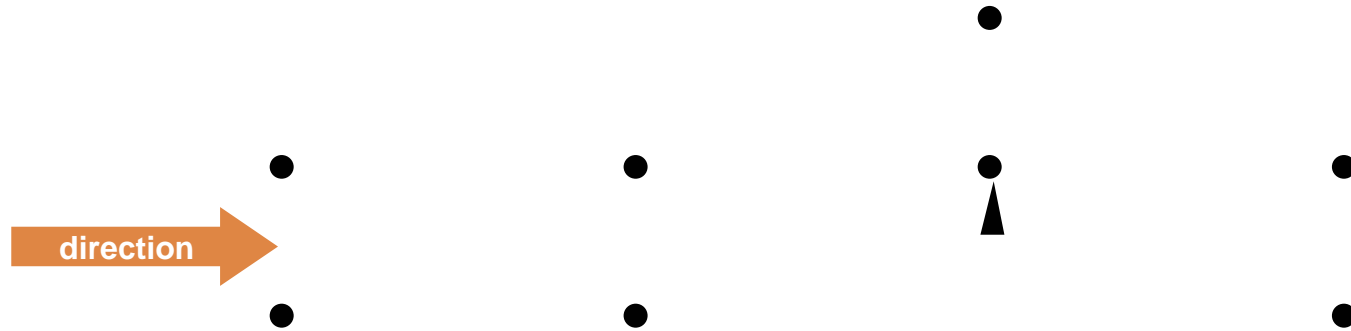
- Do not place cones or gates at intervals similar to the width of gates being used
  - For example, do not place gates going around a sweeping turn 25' or 15' apart if all of your gates are 20' wide (*see diagram on page 54*)
  - This creates a visual nightmare called “Cone Hell” since, at speed, all openings appear to be about the same size. *Arrrrgh!!! Which is gap and which is gate?*
- Make all cone walls dense enough so that at any angle, the gaps between them cannot be construed as a gate (*see diagrams on pages 49 and 54*)
- When entering a “box” or walled in turn, place the cones that appear in the approach path closer together and more frequently - creating a wall in the driver’s line of sight (*see diagrams on pages 57 and 58*)

# Gate Spacing "Rule of Thumb"

## Gated Courses

*Ratio of gate width to gate spacing should be 1 to 3 or greater.*

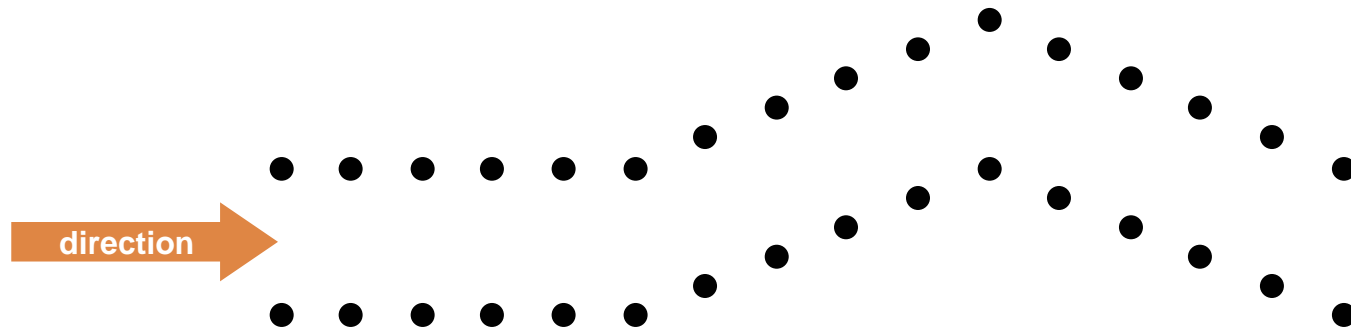
*For example, if your gate width is 20 feet the distance between gates would be 60 feet or greater*



## Miniature Road Courses

*Ratio of gate width to gate spacing should be 2 to 1 or less.*

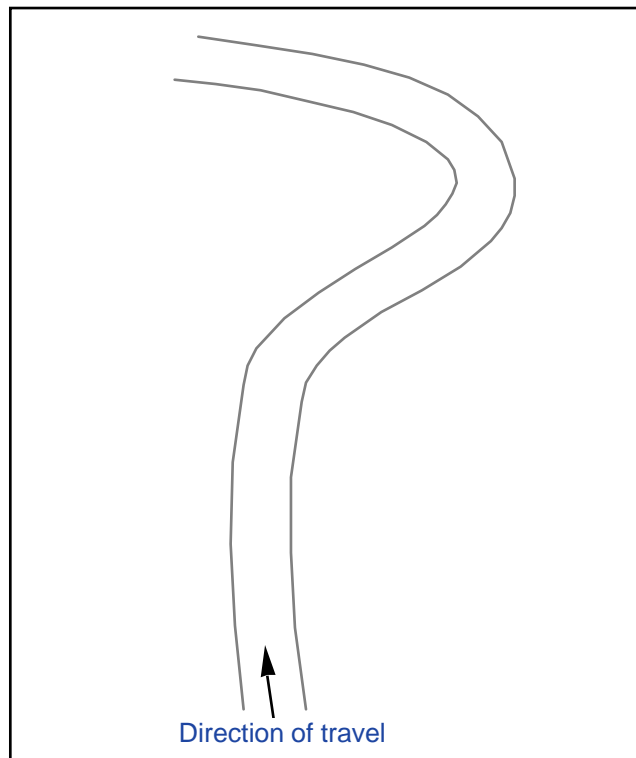
*For example, if your gate width is 20 feet, the distance between gates would be 10 feet or less*



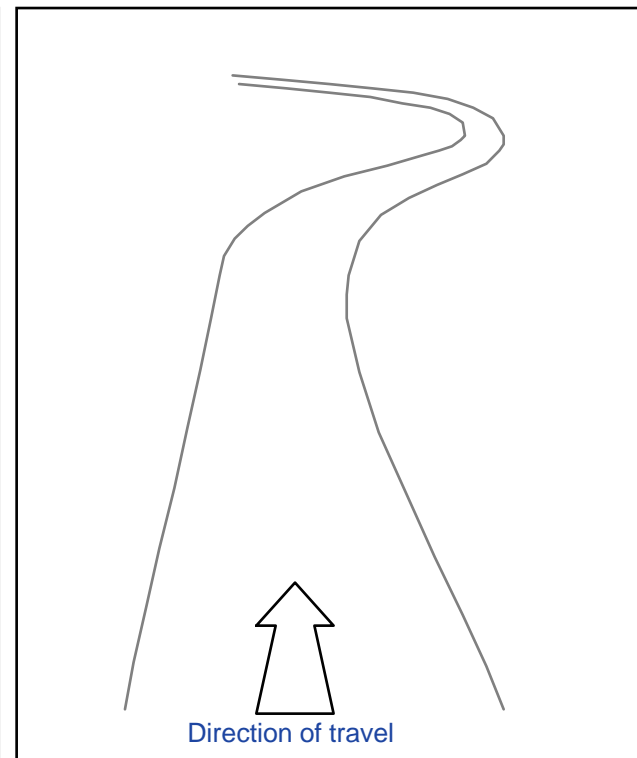
# Plan and Perspective views

- The following examples show a plan view and a perspective view of certain situations so that you can better visualize the cone configuration being indicated. What you see below is the basic path that the next 3 examples are going to take.

**Plan View**



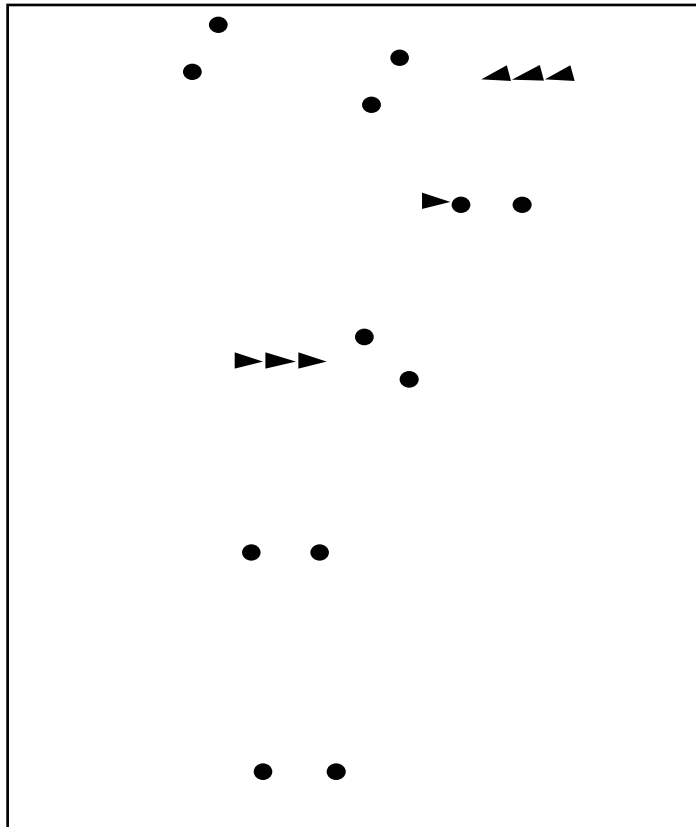
**Perspective View**



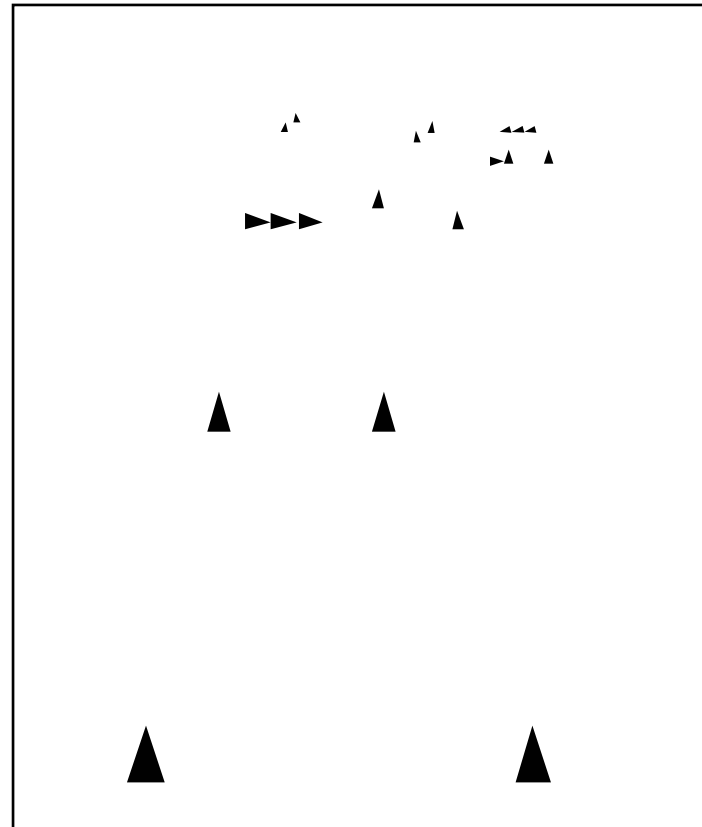
# Gates and Pointers

- This is an example of proper use of gates and pointers. The pathway is quite clear and easy to follow

Plan View



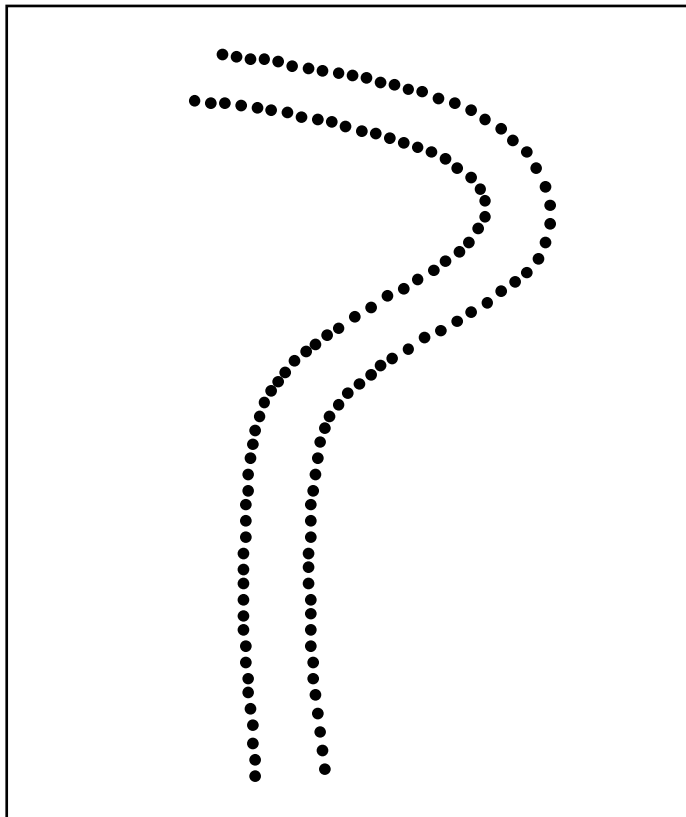
Perspective View



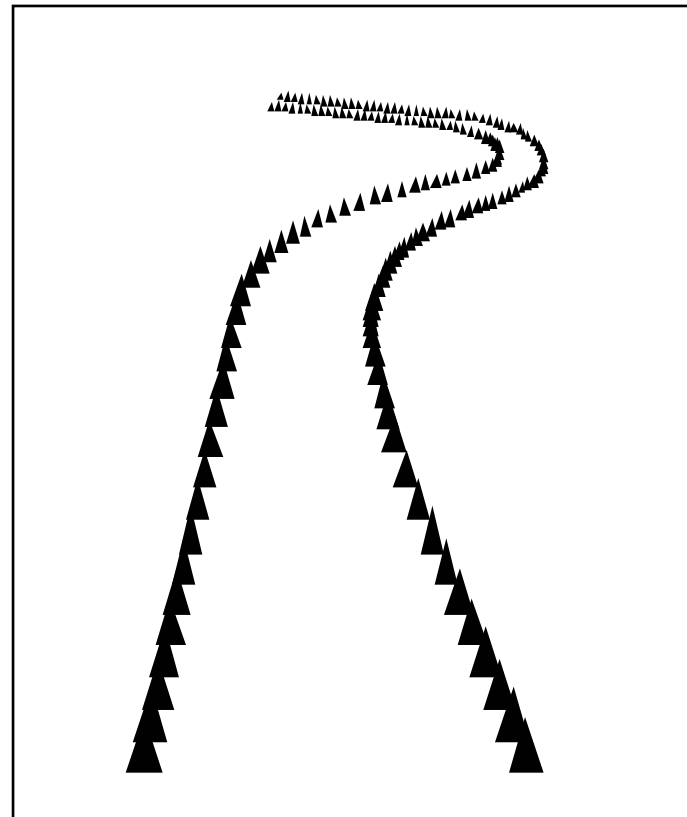
# Wall-o-Cones or Miniature Road Course (MRC)

- This is an example of the proper use of the miniature road course technique. The pathway for this is also quite clear and easy to follow

Plan View



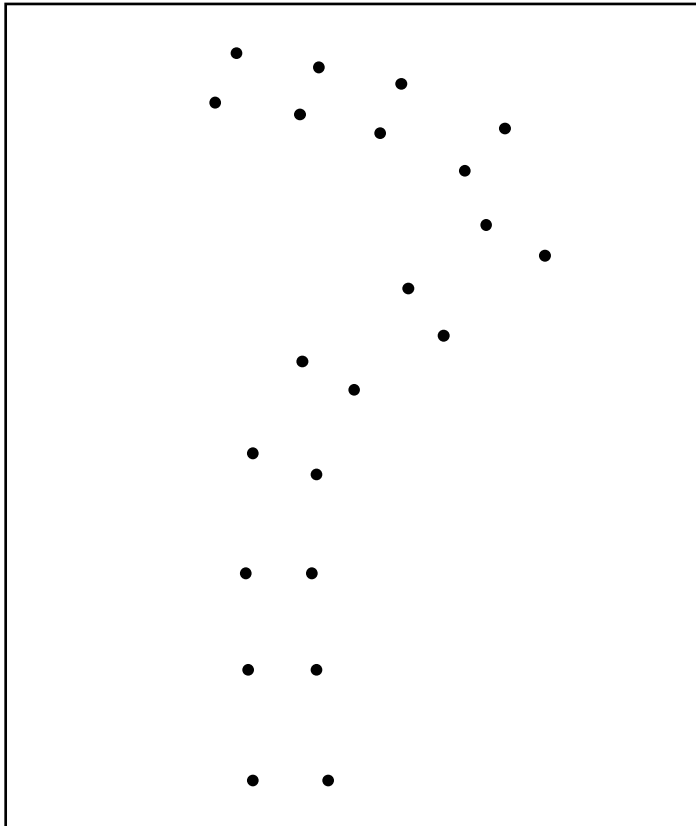
Perspective View



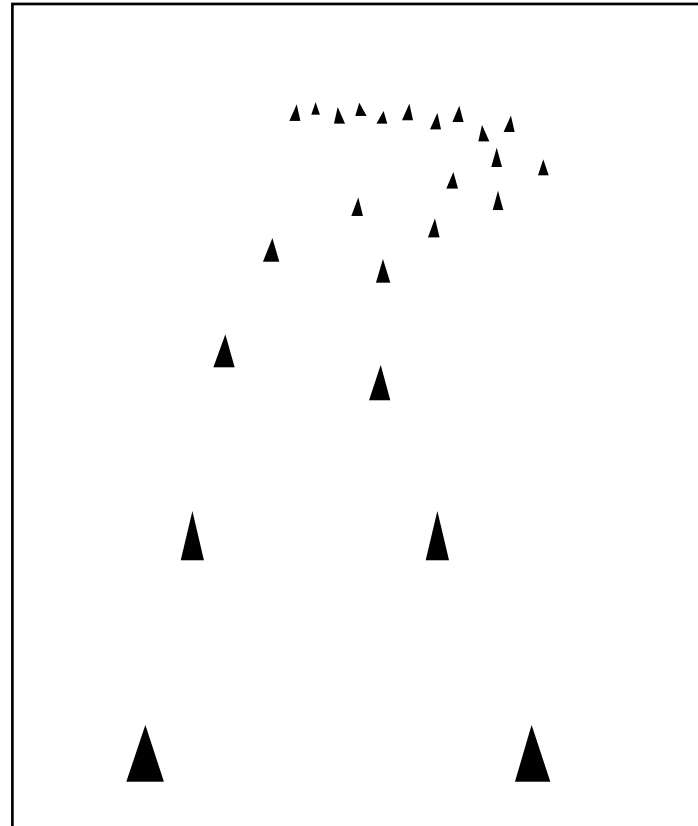
# the Dreaded "Sea of Pylons"

The dreaded sea of pylons shown here is the result of using spacing of gates similar to the gate width. As seen in the perspective view, the curve in the distance becomes vague and difficult to follow. When at speed, this effect is worsened since your mind has less time to process what is placed before it

Plan View



Perspective View

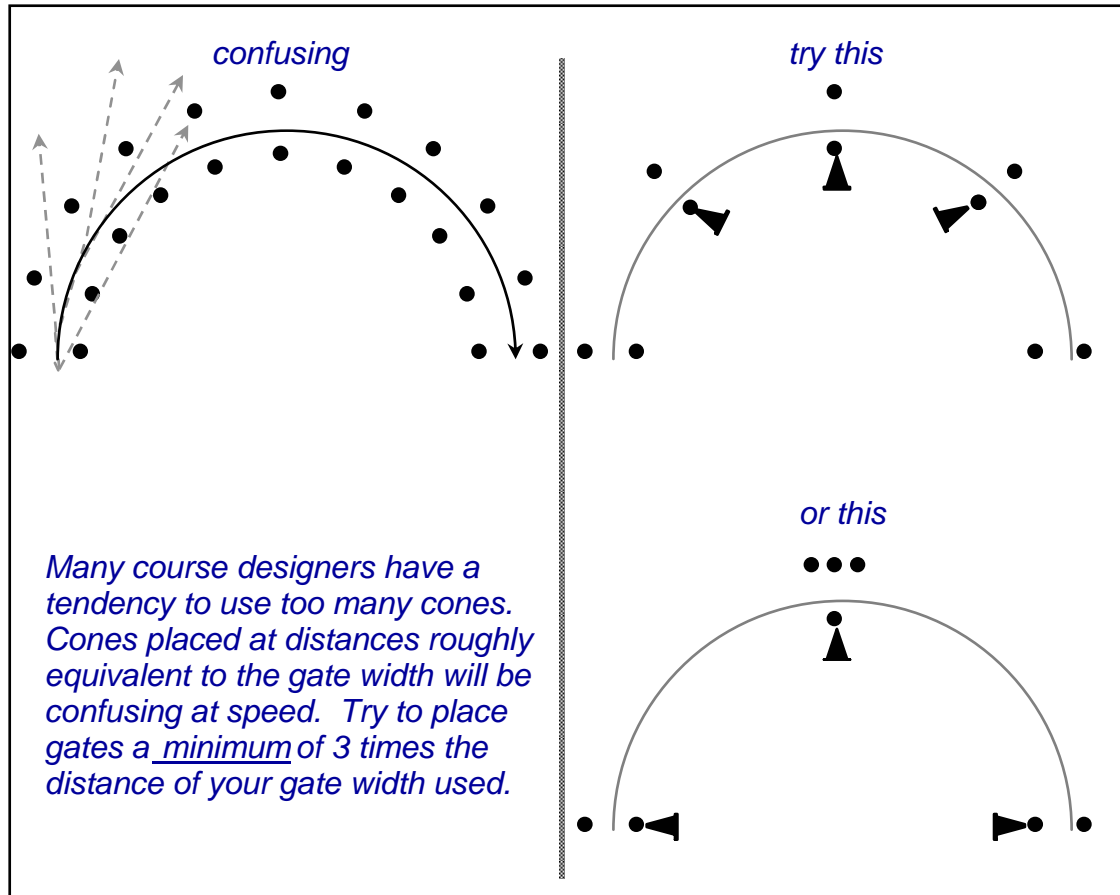




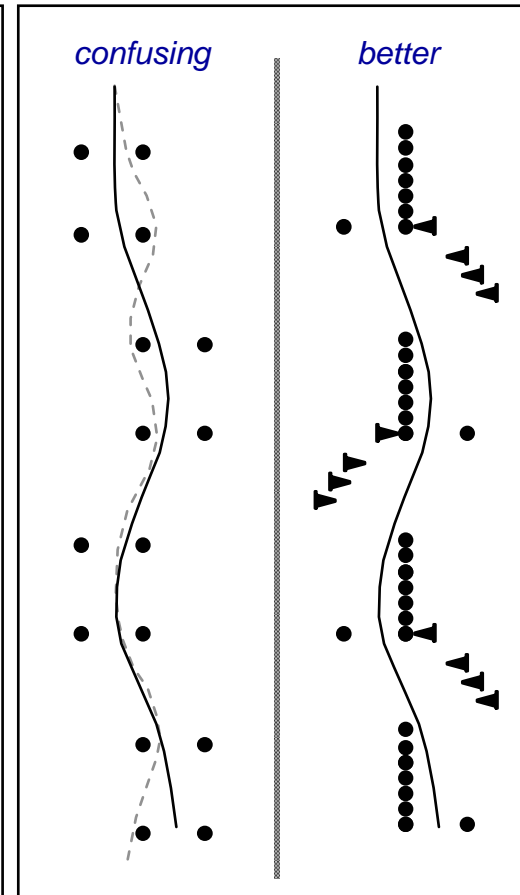
# More Examples of "Cone Hell"

Other examples that demonstrate the importance of gate spacing

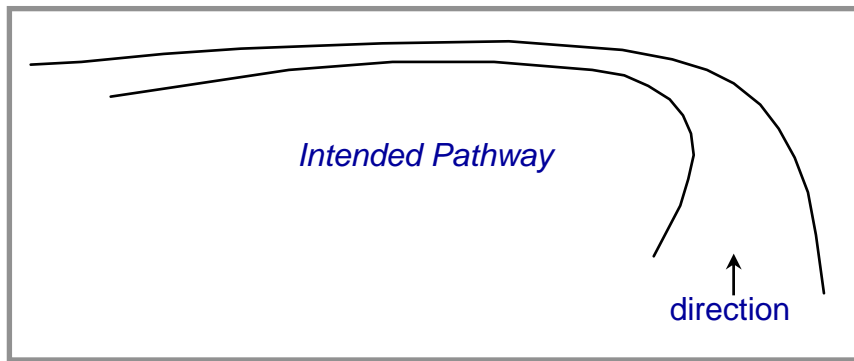
**Sweeper** (see page 55)



**Lane Change** (see page 56)

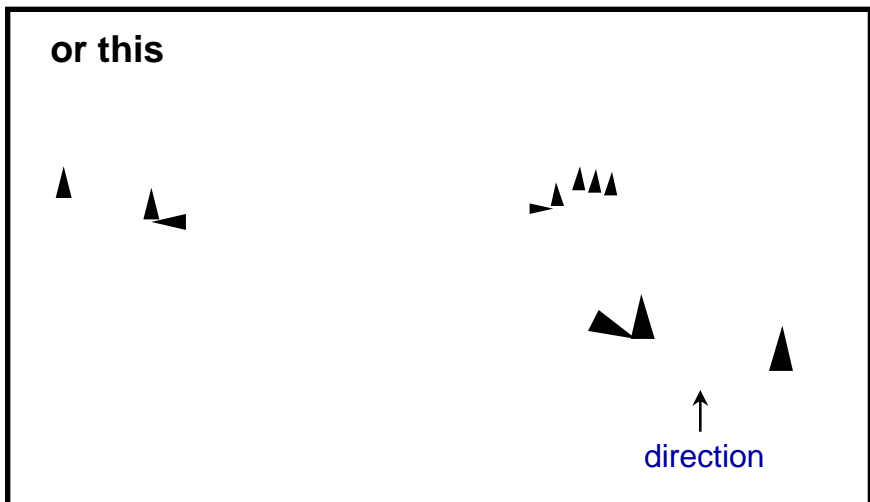
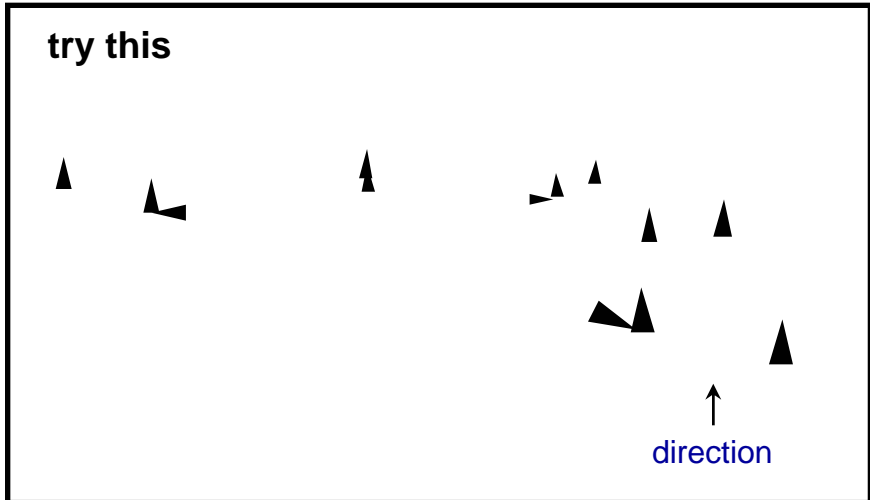
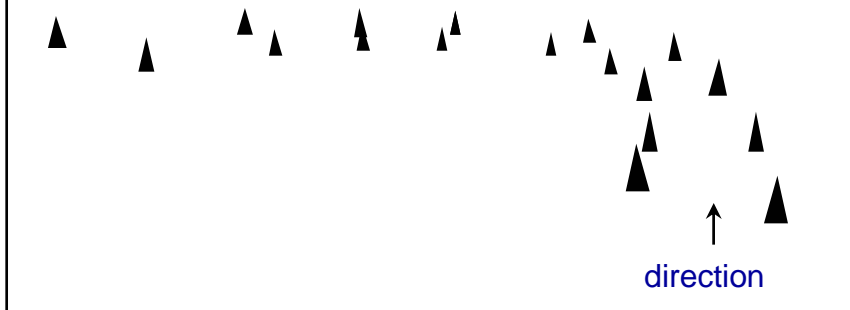


# Sweeper - Perspective View



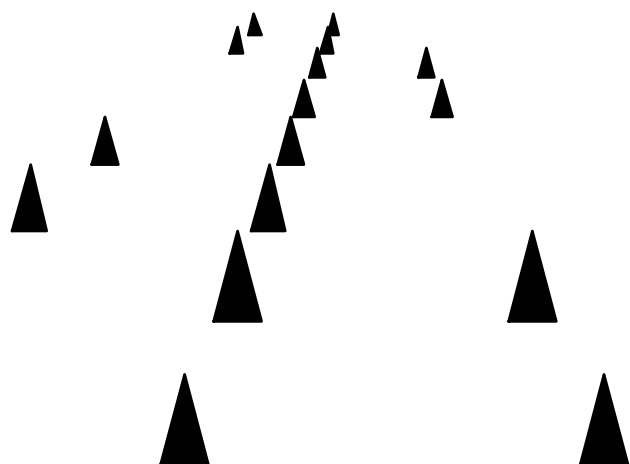
**could be confusing**

*Placing cones at similar intervals as gate width causes this effect which can be confusing at speed*

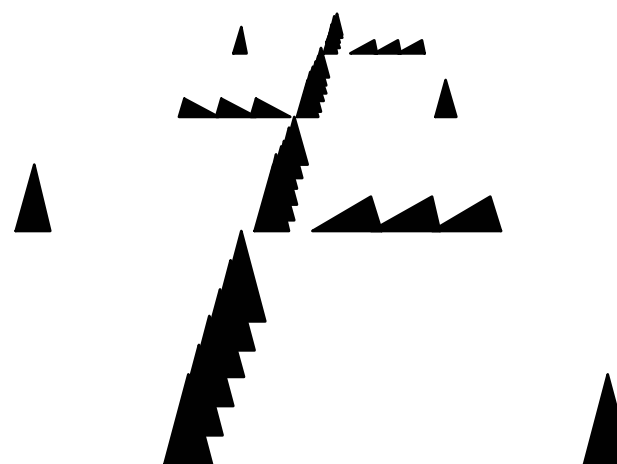


# Lane Change Perspective View

sea of cones

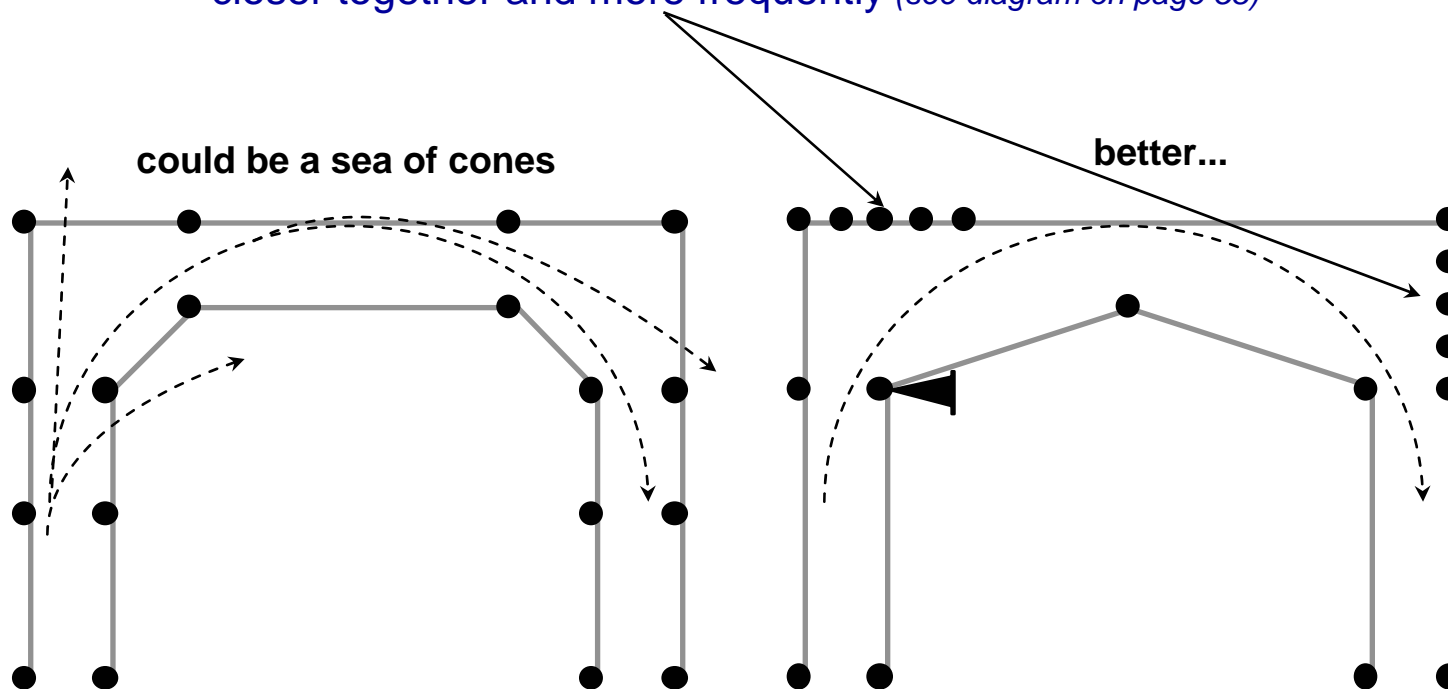


better

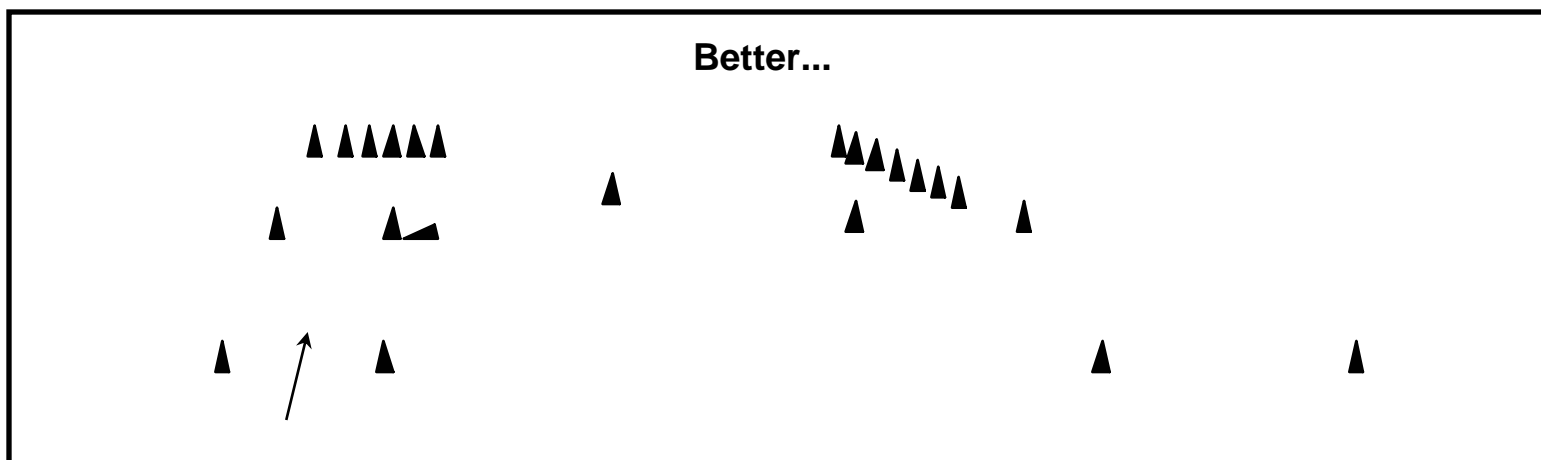
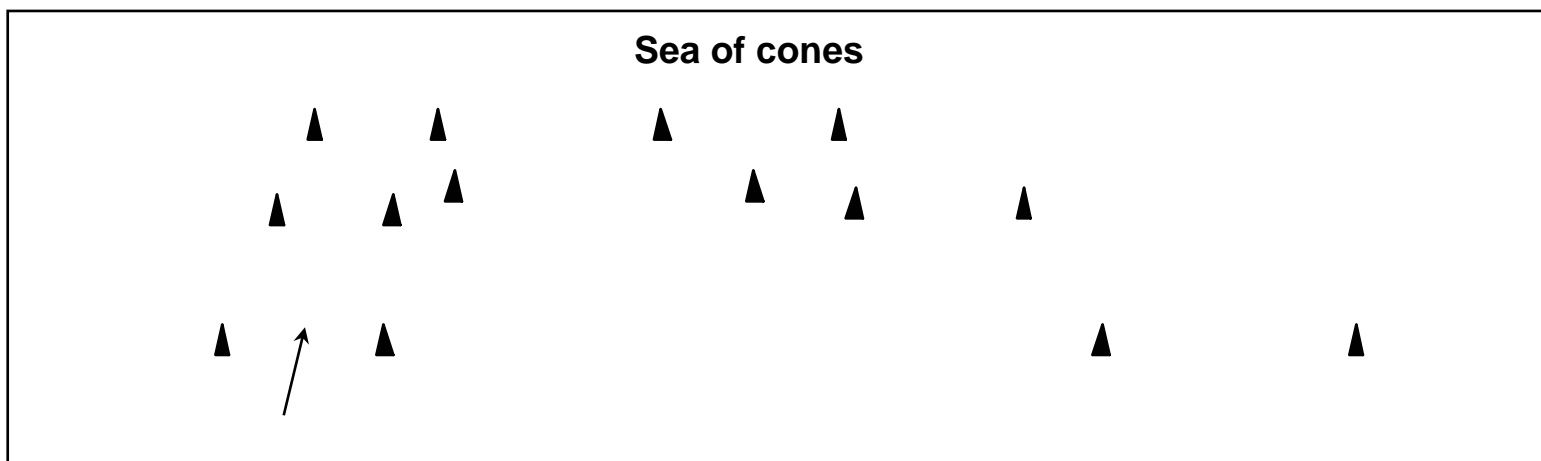


# Box Turns

When entering a “box” or walled in turn  
place the cones that appear in the approach path  
closer together and more frequently (see diagram on page 58)



# Box Turns Perspective View

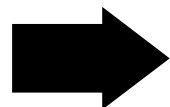


## 10.) Walk & Drive your course with the Intent of Improvement

- **Always** walk and drive your course after its initial set-up with the intent of changing it to improve the flow - I have never drawn a course, set it up and not changed at least one thing
  - Keep the **basic concept** of what your maneuver was, but improve it to make it more fun
    - Maybe it was too tight, or too fast, or visually hard to see
    - What ever the shortcoming, this is the perfect time to fix it
- Take an experienced course designer and Safety Steward with you
  - You are there when they have a suggestion
  - You are able to control the types of changes the Safety Steward makes (to maintain the basic concept of the maneuver)
  - You can discuss/analyze any of the suggestions the experienced course designer comes up with
- When not a competitor, DRIVE the course to find its shortcomings
  - If you are a competitor, designate a non-competitor whose Solo II course design opinions you trust to drive the course - and not Aunt Ethel (unless she Solo2's)
  - Make your design changes based on the inputs received from your walk through by the Safety Steward, experienced course designer and your drive through

Be a Commercial Artist, NOT a Fine Artist

- Fundamentals
- 10 Basic Concepts



## • **Simplicity and Big Event Administration**

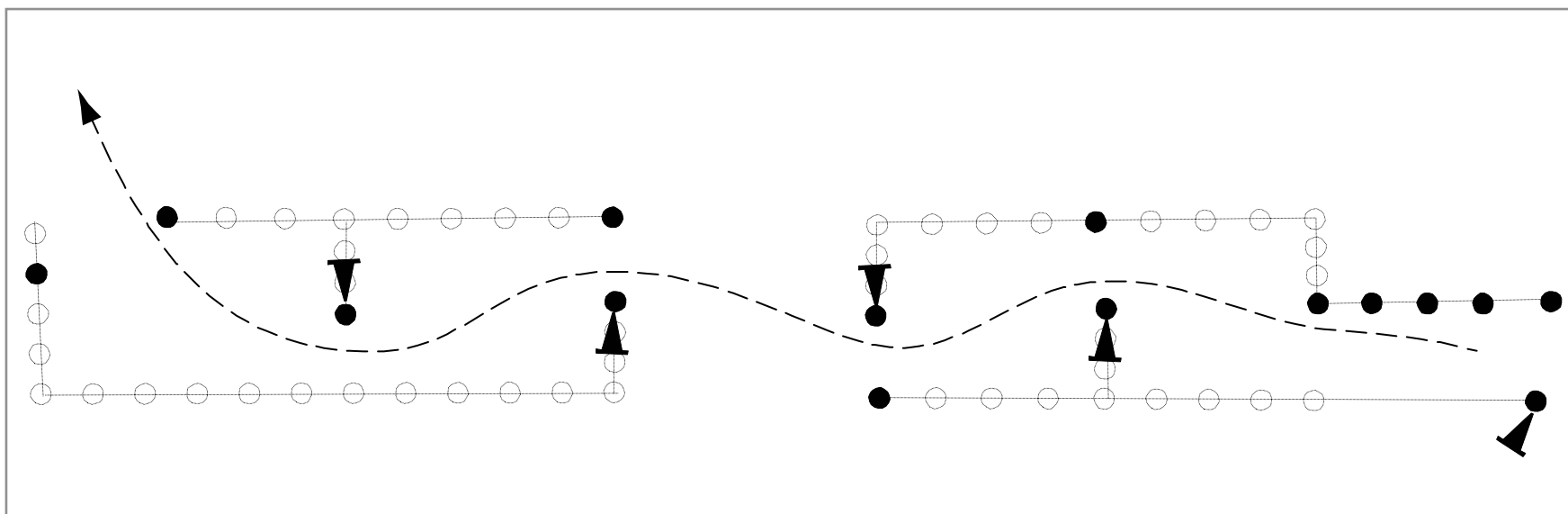
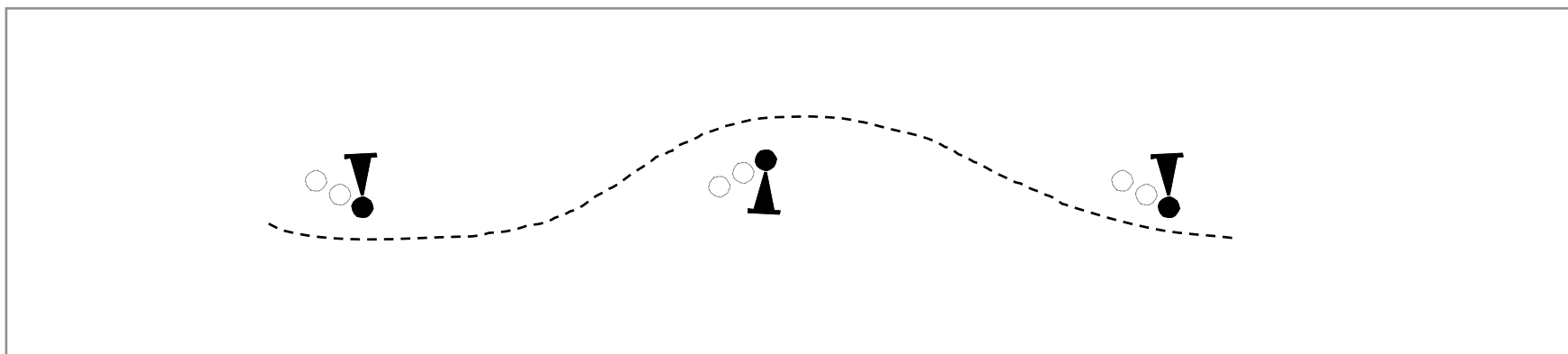
- So you have a Blank Piece of Paper...
- Elements, Dimensions and Real Speed
- Physical Application
- Summary and Questions

## How Can Superfluous Cones Cause Problems?

- Adds setup/teardown labor
- Increases course map complexity, reducing readability
- When poorly used, adds to driver confusion
- Increases likelihood of reruns; with many cones to put back, workers may not be able to keep up



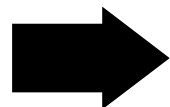
# What Are Superfluous Cones?



## When to Consider Avoiding Superfluous Cones

- Big Events (Tours, Nationals)
  - Reruns pollute competition integrity
  - Course work quality should be a priority
  - Visual BS cones add little to the competition; good drivers are unaffected by them
- High-turnout Events
- Worker Shortage Situations
- Very Hot Climates

- Fundamentals
- 10 Basic Concepts
- Simplicity and Big Event Administration
- So you have a Blank Piece of Paper...



- **Elements, Dimensions and Real Speed**

- Physical Application
- Summary and Questions

## So You Have a Blank Piece of Paper *(DOH!! what now???)*

- This section contains a method to use that will enable you to put your ideas and the 10 basic concepts you've just gone over down on a piece of paper
  - I have found that at times, a blank piece of paper can be *extremely intimidating*
  - The following section will hopefully alleviate that problem and make this task easier for you as it has for me

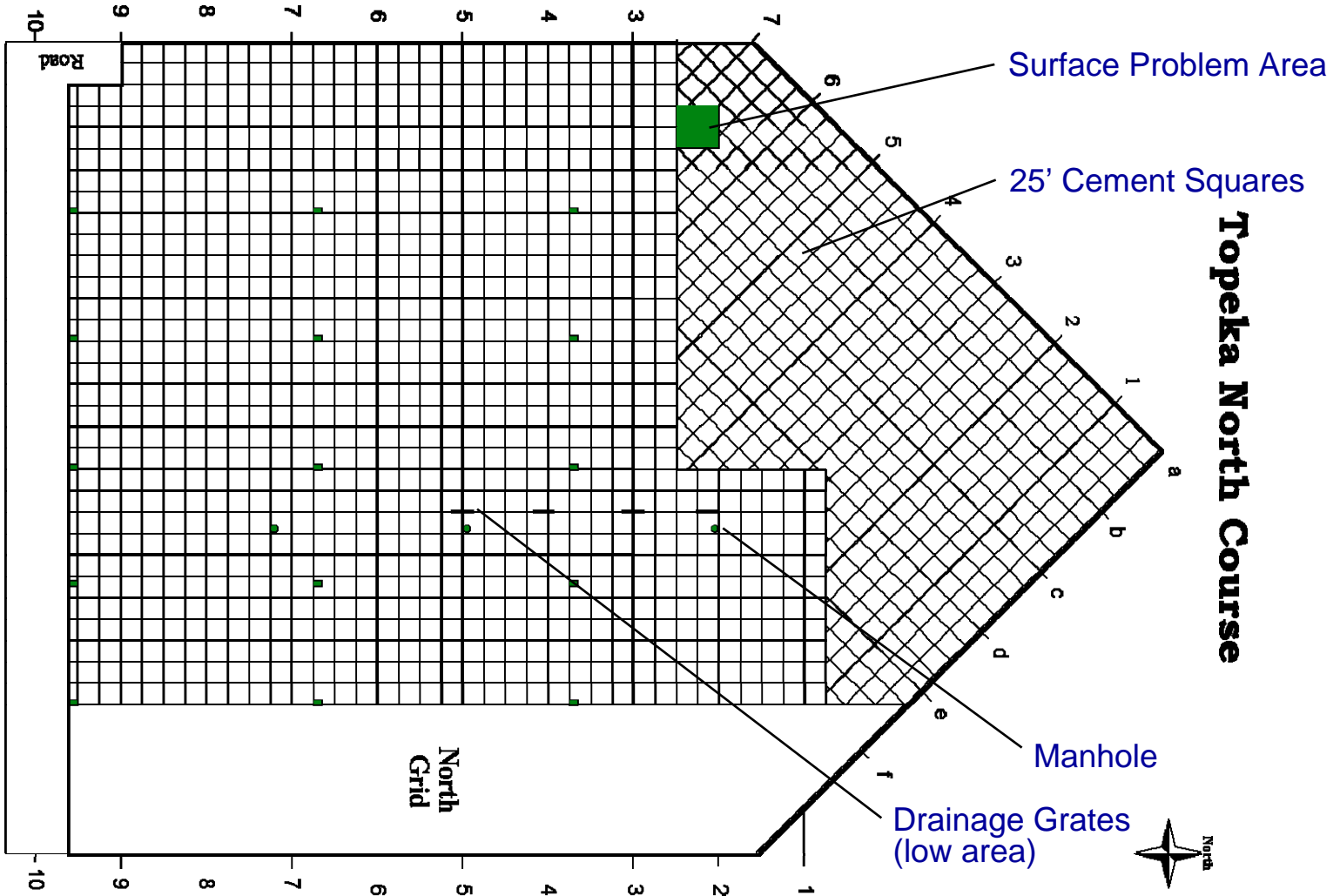
*So You Have a Blank Piece of Paper*  
**Before You Start  
Your Glorious Creation**

- Make the job easier and improve your chances of success
  - Acquire or make a reasonable scale map of the event site that contains the following information:
    - The *accurate* overall shape and size of the course area
    - Map scale information
      - Dimensions of parking stalls
      - Concrete square dimensions
    - Locations of:
      - Surface problems (grates, holes, oil, etc.)
      - Immovable objects (light poles, buildings, curbs, planters, trees, etc.)
      - Boundary features (fences, sidewalks streets, etc.)
      - Entrance and Exits
      - Elevation changes and/or sloped sections  
(*such as at drainage grates - see diagram on page 28*)

*So You Have a Blank Piece of Paper*  
**Before You Start**  
**Your Glorious Creation**  
(continued)

- Address logistics involving non-course features on your map as well
  - Competitor entrance(s) and waiver patrol points
  - Pit areas
  - Grid
  - Run-out for the finish
  - Required boundary buffers for spectator areas  
*(see diagram on pages 27)*
  - Registration location
  - Technical inspection location
  - Timing vehicle/trailer/tent positioning
  - Number of cones available
- the following page has an example of a Map that I created for the 1995 Solo II Nationals North Course Area at Forbes Field in Topeka

*So You Have a Blank Piece of Paper*  
**Scale Map of the  
 Topeka North Course Area**



## Design Goals

- Consider the course attributes that meet good design goals
  - It follows the ten basic concepts
  - It is easy to find
    - The general route makes sense
    - It can be walked the first time without a course map by an experienced driver
    - It can even be driven by experienced drivers without a walk-through
  - It is easy to remember
    - The sections connect well and make good sense
    - The style and visual clues are consistent and clear
    - Its directional flow leads drivers along the correct path
  - It is hard to drive “right”
    - Lines, discipline, calculated aggression and car control are all critical to having a good competition run
    - Sloppy runs result in slow times
    - Novices are noticeably slower than the experienced drivers in similar cars

All of these things will provide “Fair, Fun and Safe Competition”



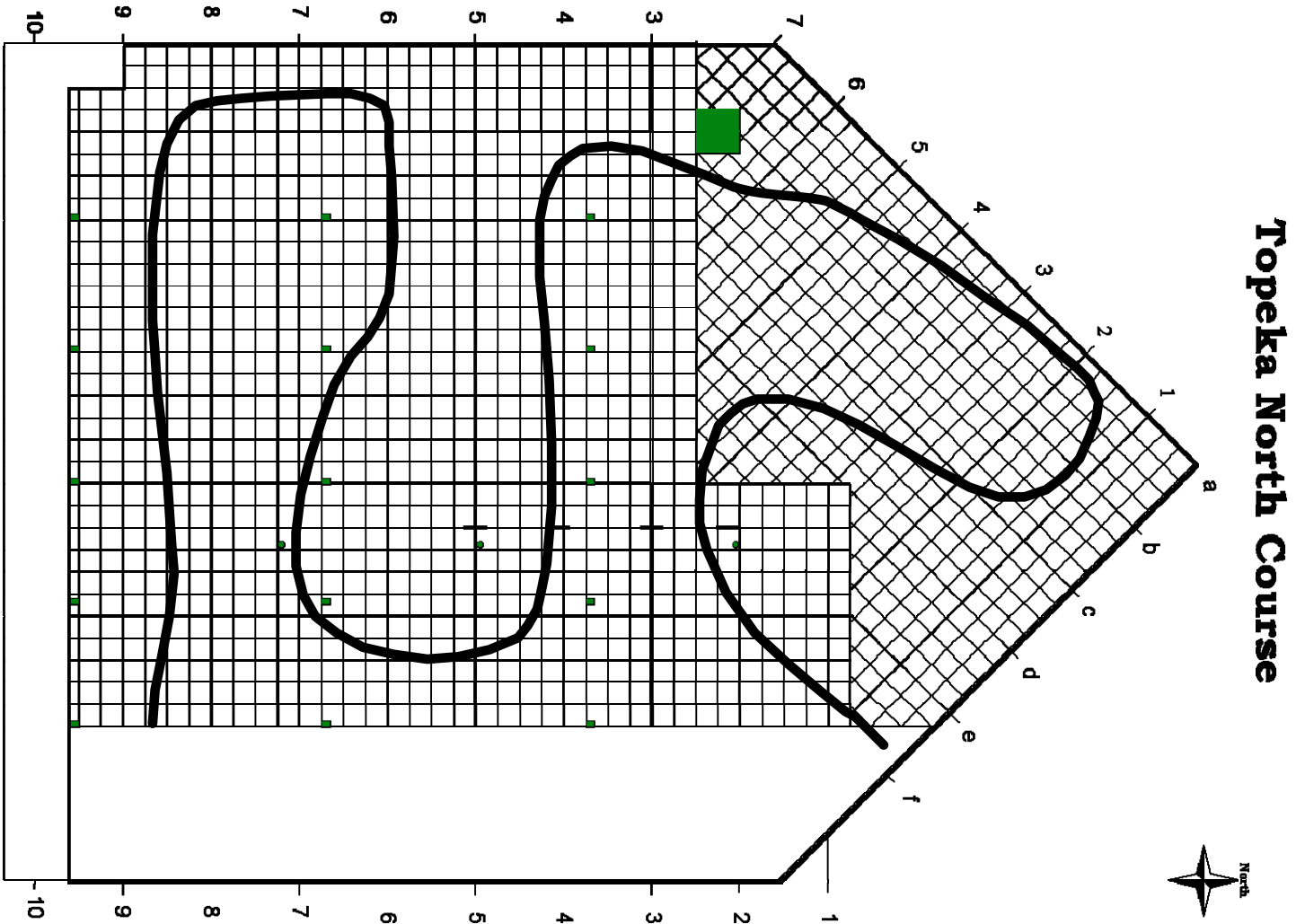
*So You Have a Blank Piece of Paper*  
Getting Started (Finally...)  
**Position the Start and Finish**

- Position the finish area first
  - Runoff area
  - Exit from the course area (tightly defined)
  - Return route to grid
  - Location of finish lights
  - What type of finish?
  - Avoid maneuvers which encourage control loss or require heavy application of the brakes just before the lights
  - Try to ensure that the projected timing vehicle location will have a clear view of the finishing cars
- Position the start area next
  - Staging line
  - Access from the grid
  - Location of the start lights
  - What type of start?
  - Try to ensure that the projected timing vehicle location will have a clear view of the starting (and finishing) cars

*So You Have a Blank Piece of Paper*  
**Sketch General Routes  
Through the Site**

- Determine number and directions of turns
- Consider the location of the straightish sections
- Anticipate possible course worker station positions
- Keep in mind distance to boundaries and immovable objects
- Allow for multiple cars on course if necessary
  - Avoid crossovers
  - Provide separation between adjacent sections
- Provide a variety of different types of maneuvers
  - Make a list of the desired items for the course
  - Decide which portions of that route lend themselves to each of the listed elements
- Do several general sketches - there is no single “right” route
- Pick the ones that seem the best and fill them in
  - Adjust turn radii and shapes
  - Add transients where applicable
  - Ensure a diversity of elements
- Decide what your presentation format is and be consistent
  - Gate style (line or unlined)
  - Walled style (lined or unlined)
  - A combination thereof

*So You Have a Blank Piece of Paper*  
Example of a sketch

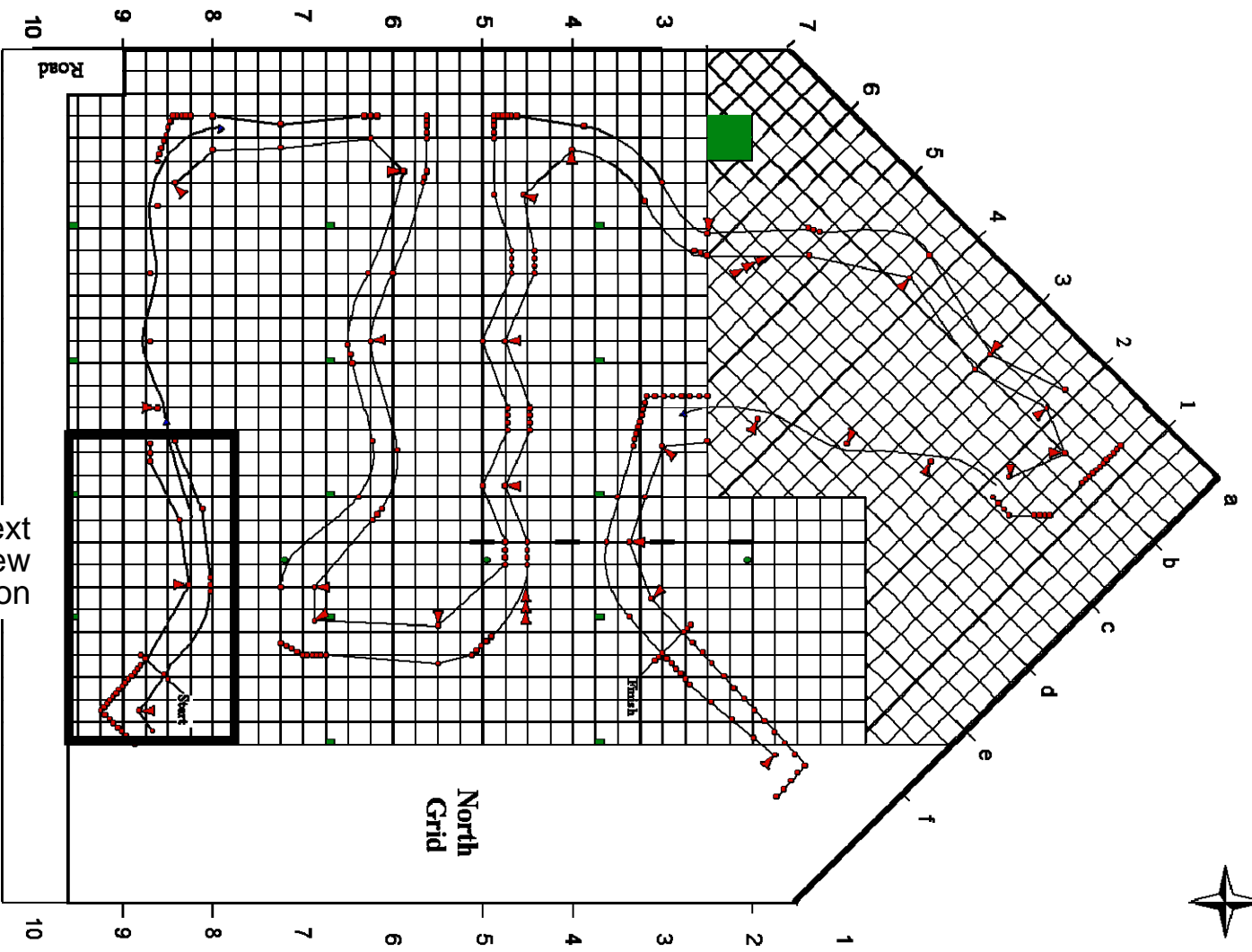


*So You Have a Blank Piece of Paper*  
**Finalizing the Design**

- Add projected cone locations
  - Think about visual cues and clear markings  
(see pages 48 - 58)
    - Don't assume that the white chalk line will help guide the drivers
      - Rain or wind may eradicate those lines during an event
    - Consider approach speeds to allow for driver error  
(see diagrams on pages 26, 27 and 30)
    - Create patterns by repeating cone formations
      - Pointers on apexes
      - Four cone walls on outside of turns
      - Consistent gate widths, etc.
  - Avoid Excess cones where not required for a desired visual
  - Prioritize key cones  
(see diagrams on pages 35 and 36)
  - Allow room for adjustment in all directions; no course should be expected to be set up on site exactly as it was drawn on the map
    - 10' minimum movement allowance of individual cones, gates or even entire sections

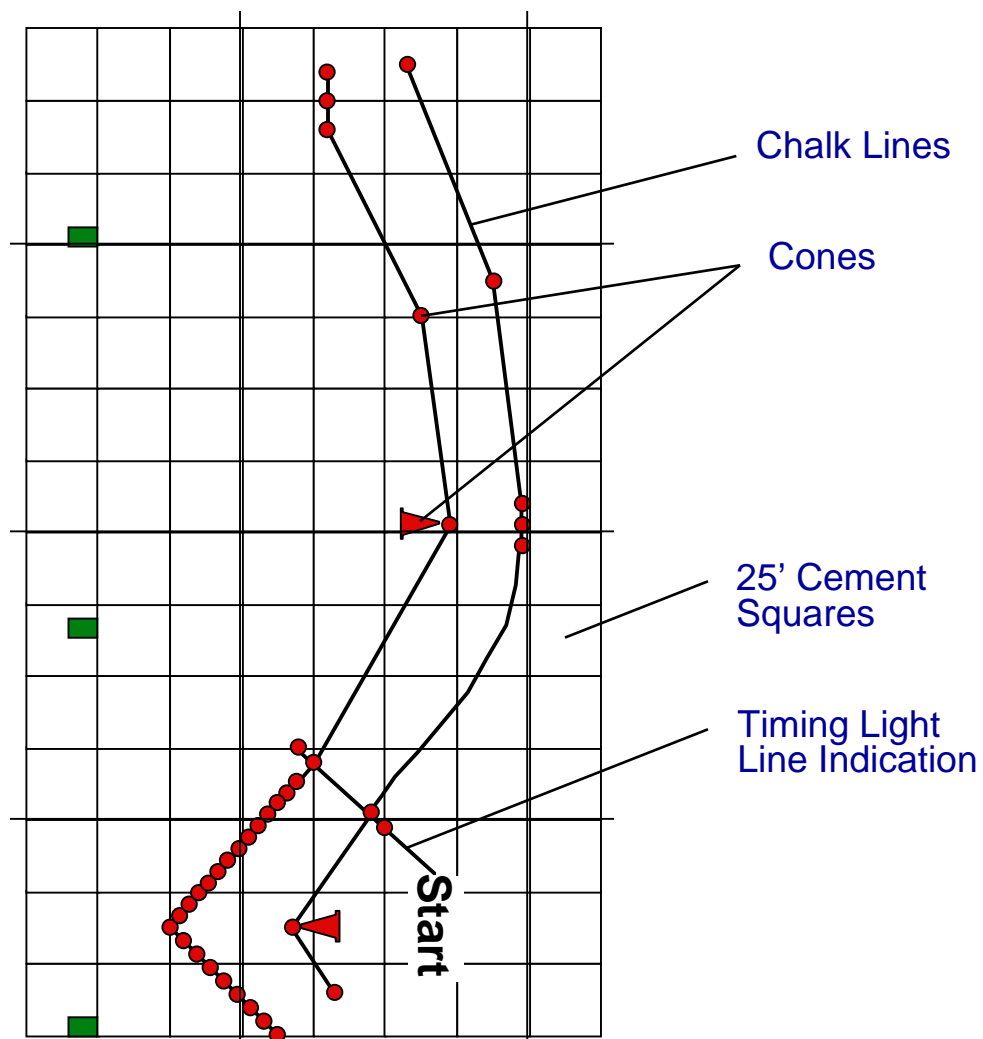
*So You Have a Blank Piece of Paper*  
**Finalized Design Example**

**Topoka North Course**



See next page to view this section

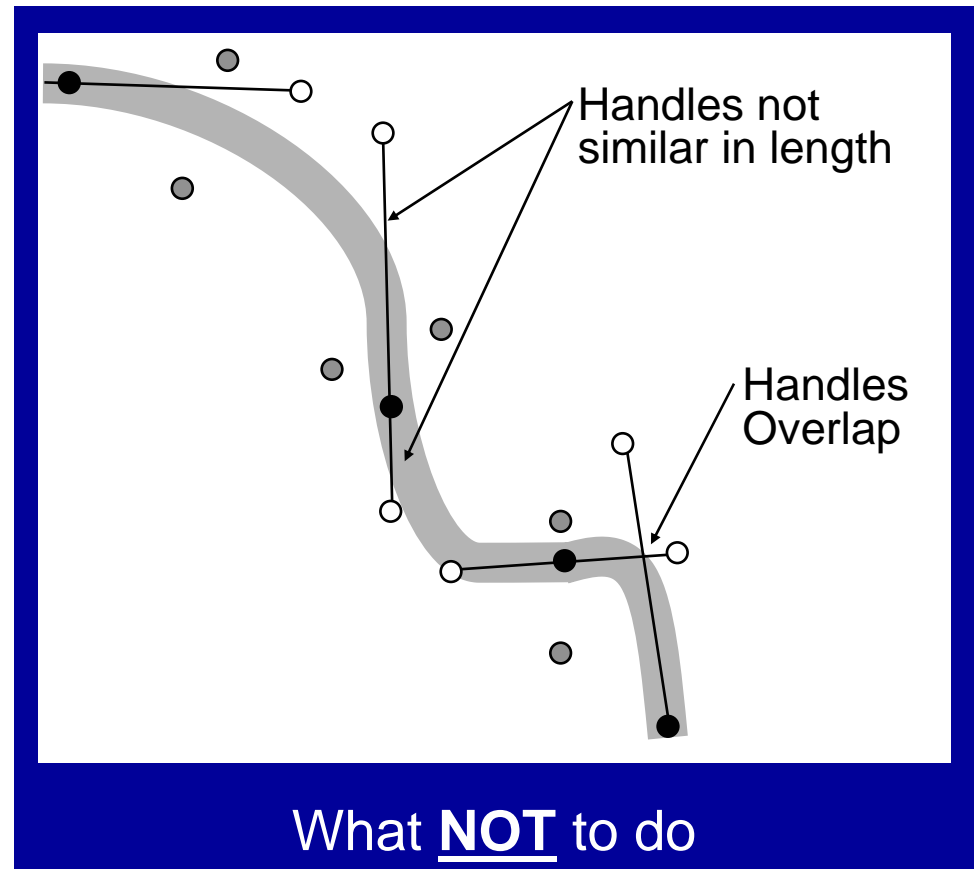
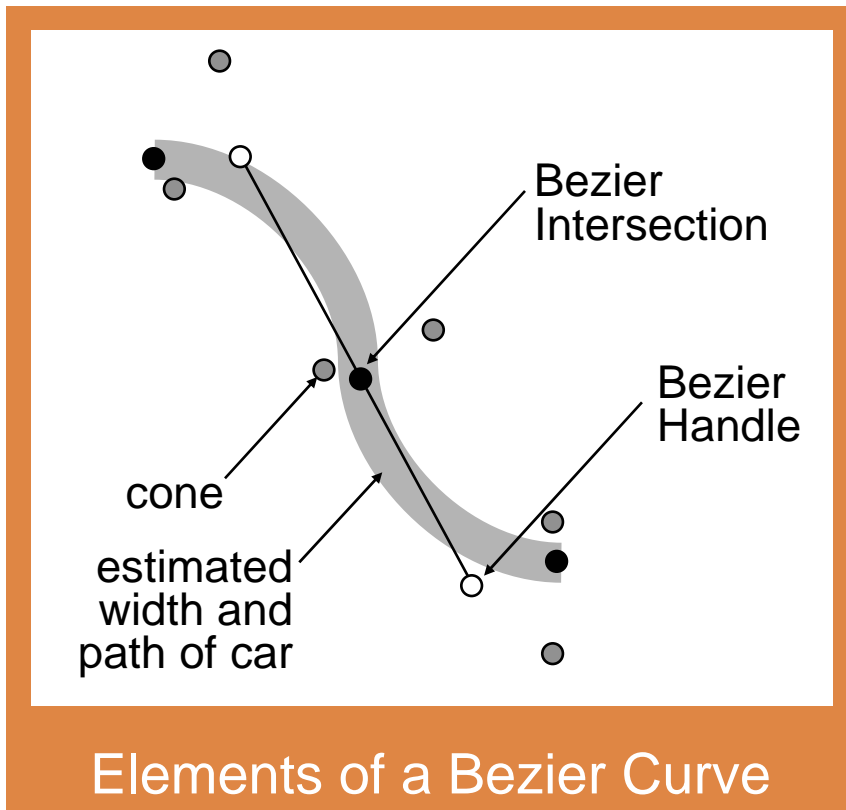
*So You Have a Blank Piece of Paper*  
**Section from  
Finalized Design**



# Computer Design Analysis

- The following assumes that you have access to a fairly powerful computer with a current Graphics program that utilizes bezier curves and lines such as Adobe Illustrator, Deneba Canvas, Corel Draw, etc.
  - When you input your design into a computer to scale, you can analyze how well the course flows by plotting the probable path of a car (*see diagrams on pages 77, 78, 79, 80, and 81*)
    - Create a probable path of the car using a bezier curve the approximate width of a car
      - Most cars are about 6 feet wide
      - Place your bezier intersections at probable apex points
    - Adjust the bezier curves to create the fastest (shortest) path through the course without clipping any cones
      - Strive to have the line as smooth as possible
      - Make your bezier handles similar in length
      - Do not have bezier handles overlap each other

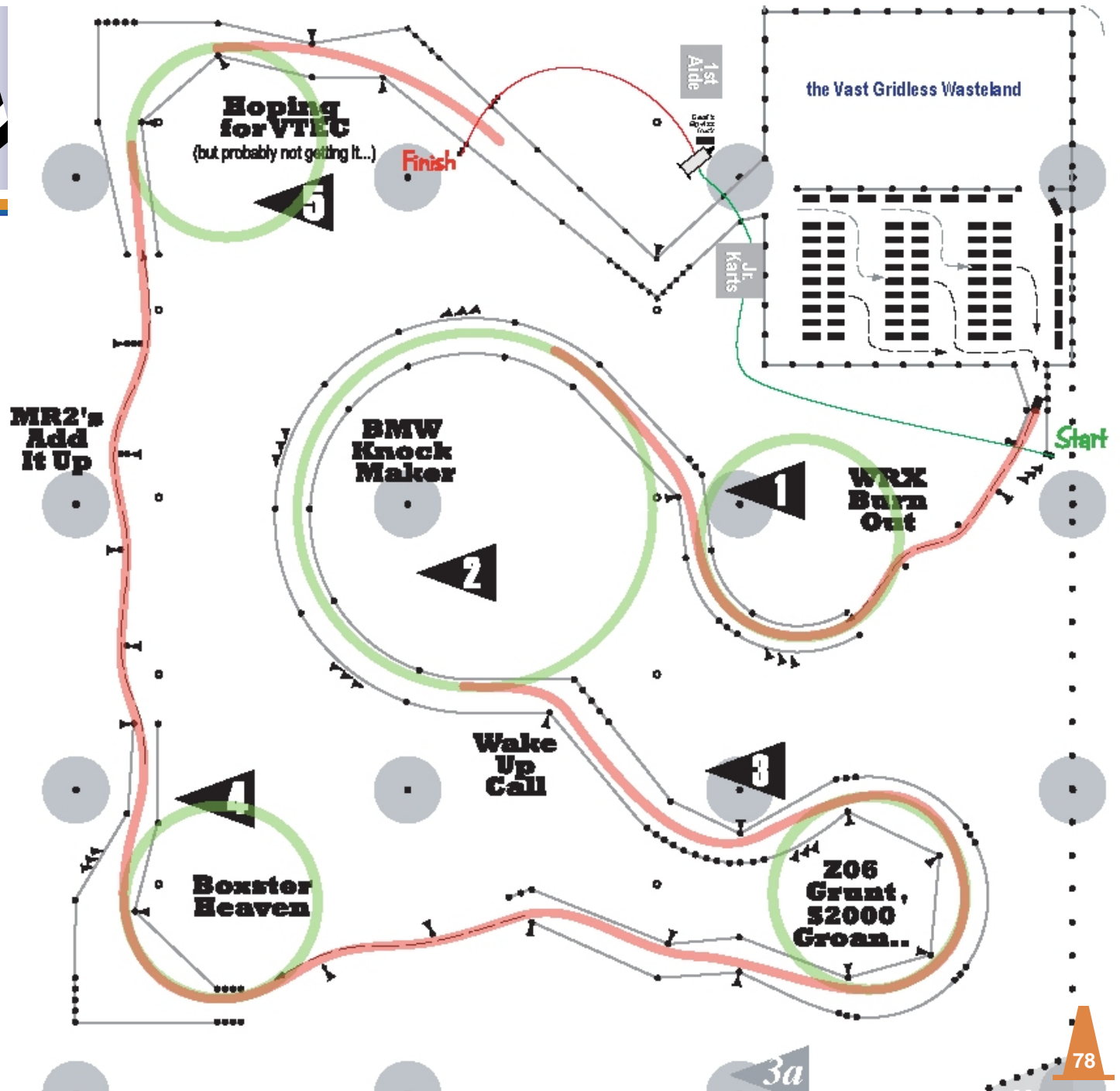
# Computer Design Analysis (continued)

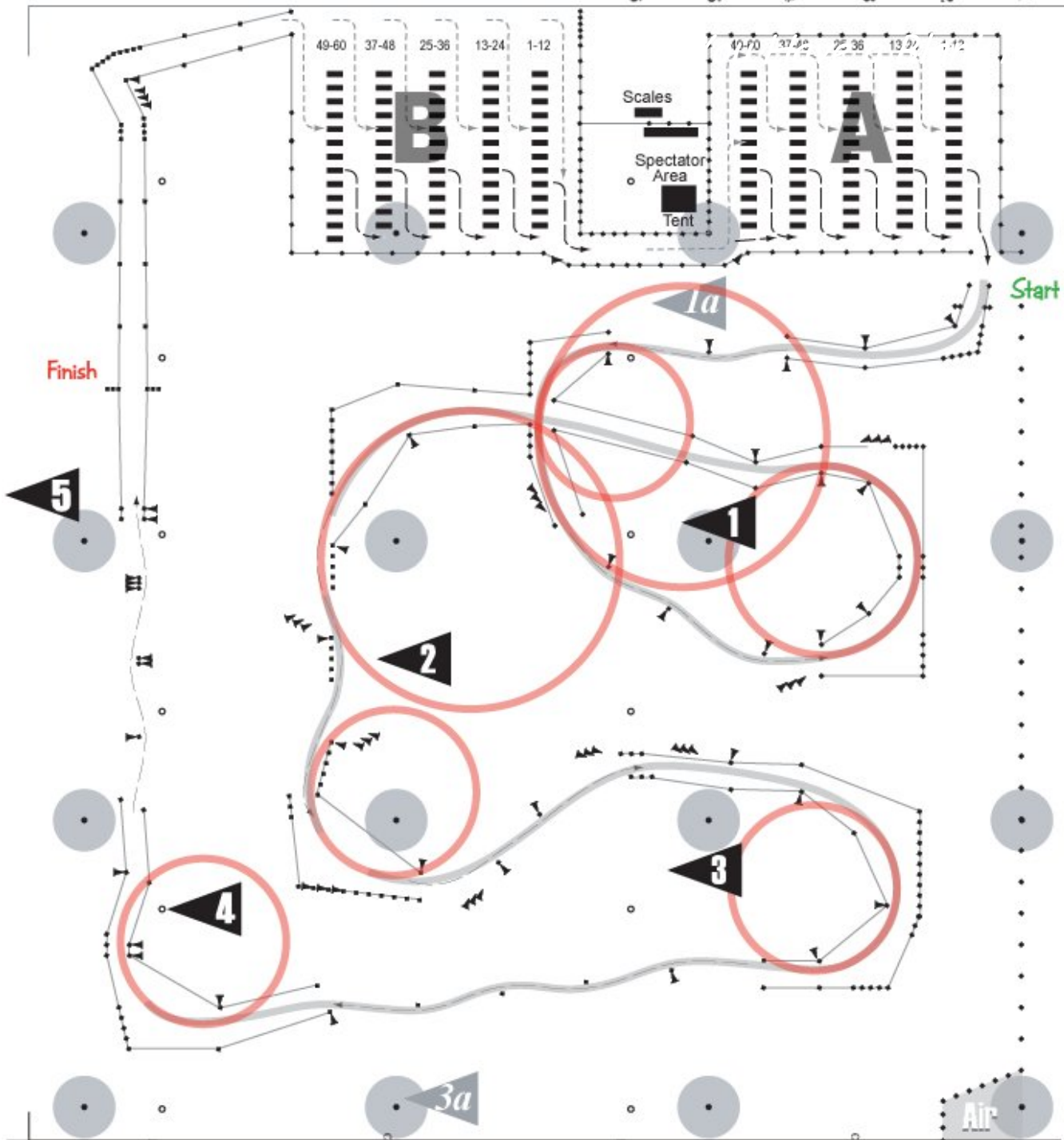






Bezier curve analysis helps to plan a fast line through sections that look slow, as well as discover sections that look fast but are truly painful

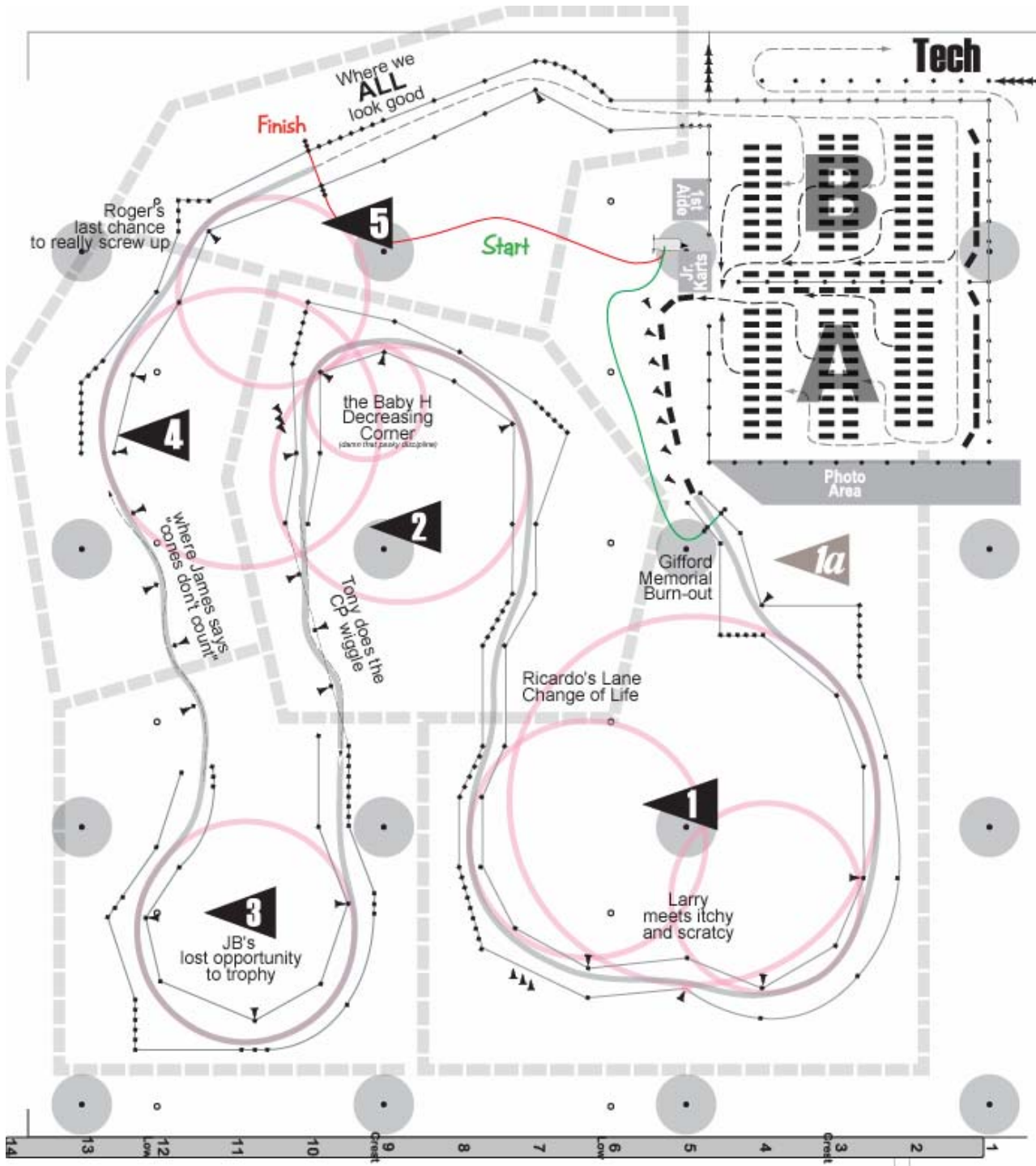




**Pits**  
 (between course and road)

The Houston Region SCCA Proudly Presents:  
**Texas Seagull Target Practice**  
**Day 1**  
 designed by Roger Johnson

Dog Track Facility



The Houston Region SCCA Proudly Presents:

# Larry's Disturbing Vision

## Regional Event #1

Designed by Roger Johnson

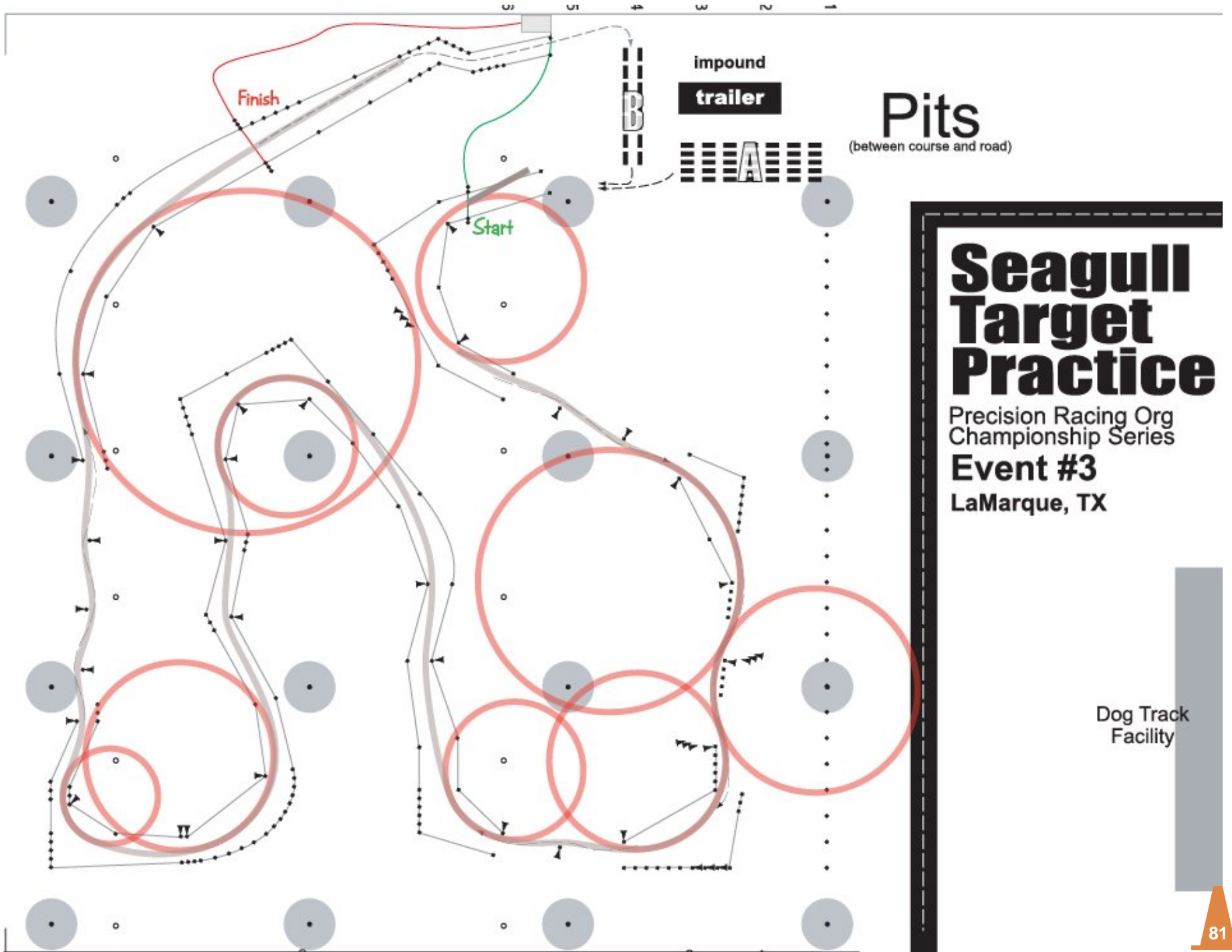
Car # \_\_\_\_\_

Class \_\_\_\_\_

Run Heat \_\_\_\_\_

Work Heat \_\_\_\_\_

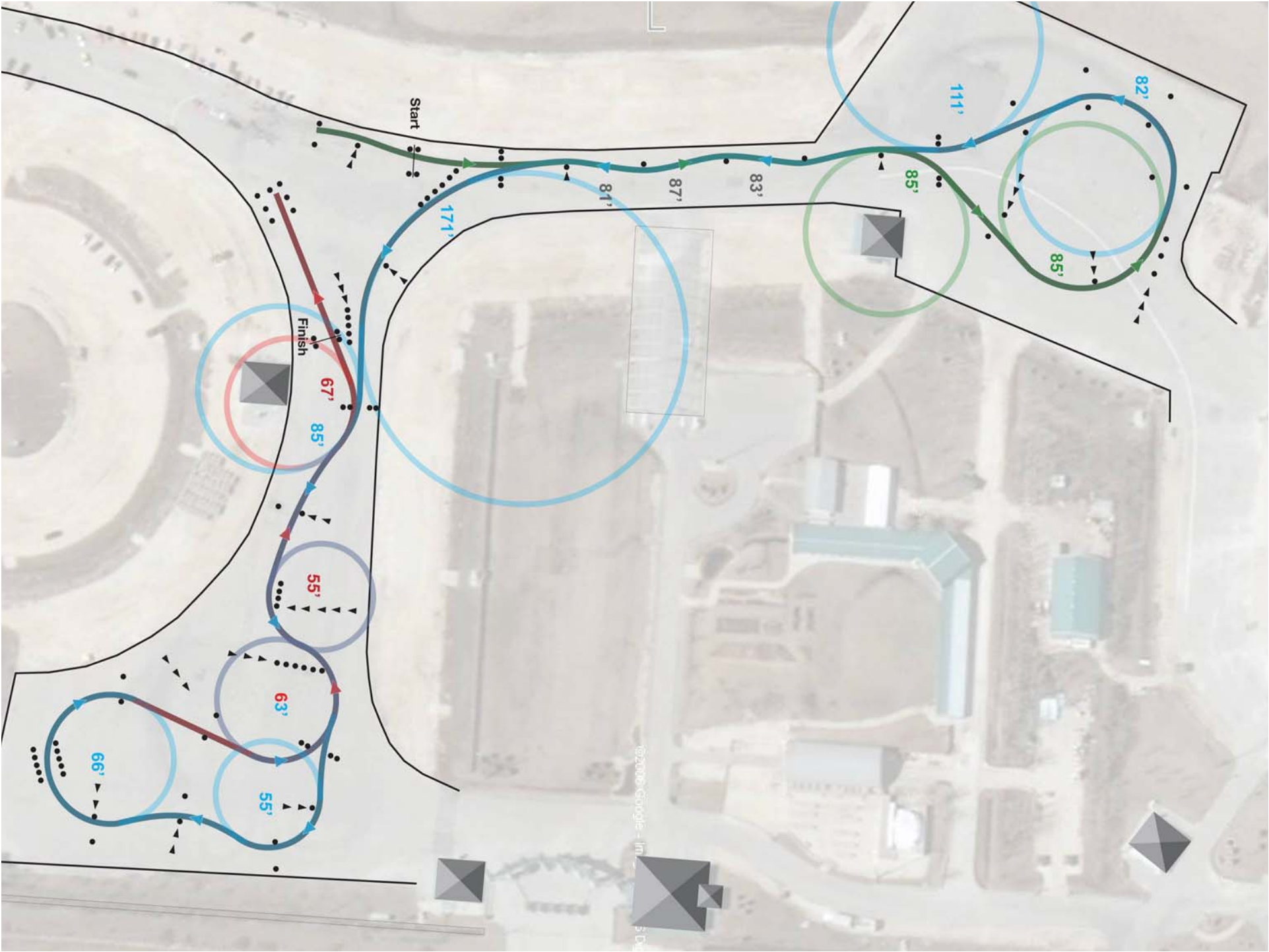




# Seagull Target Practice

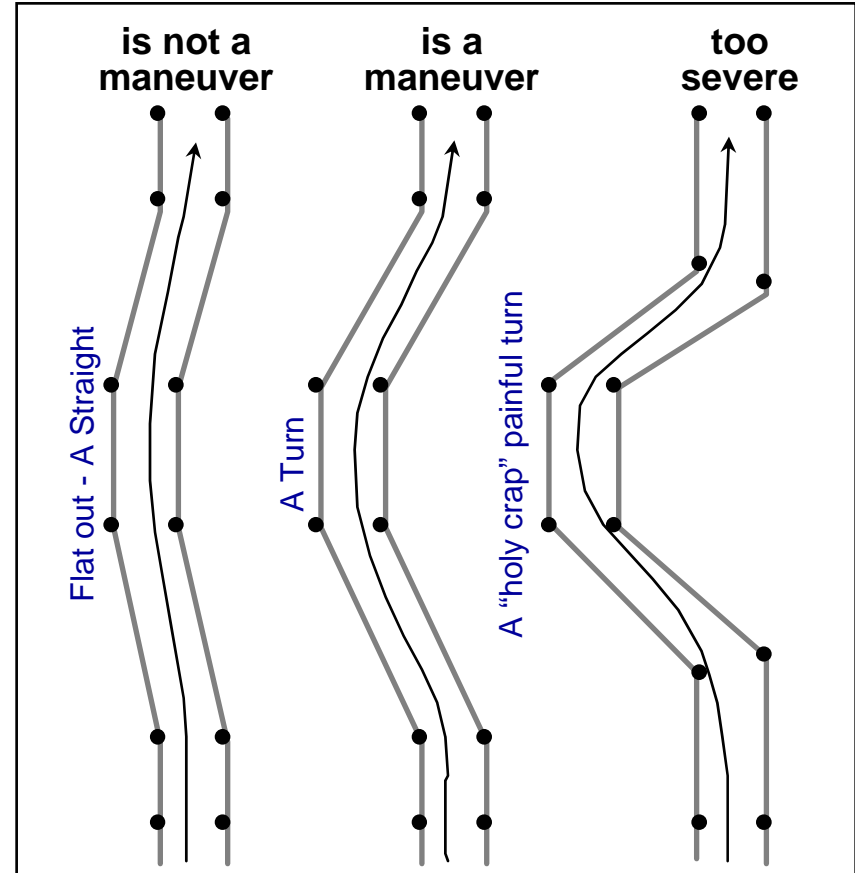
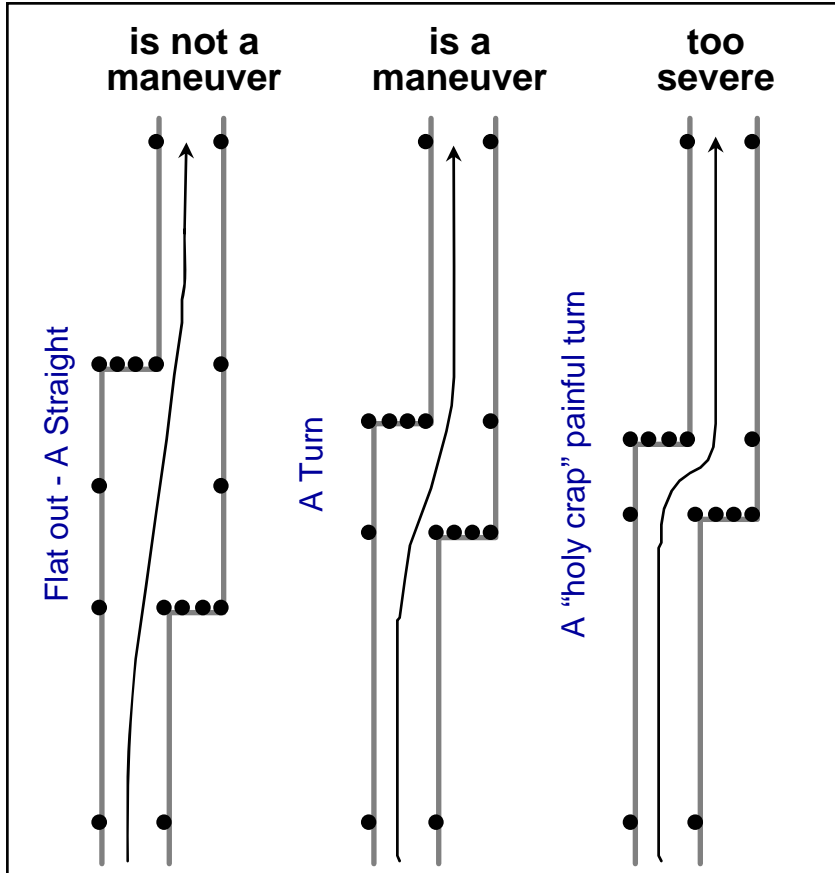
Precision Racing Org  
Championship Series  
**Event #3**  
LaMarque, TX

Dog Track Facility



*So You Have a Blank Piece of Paper*  
**When a Maneuver isn't...**

While setting up your course, check to see that all maneuvers are indeed maneuvers. Also ensure that they are not more severe than you intended

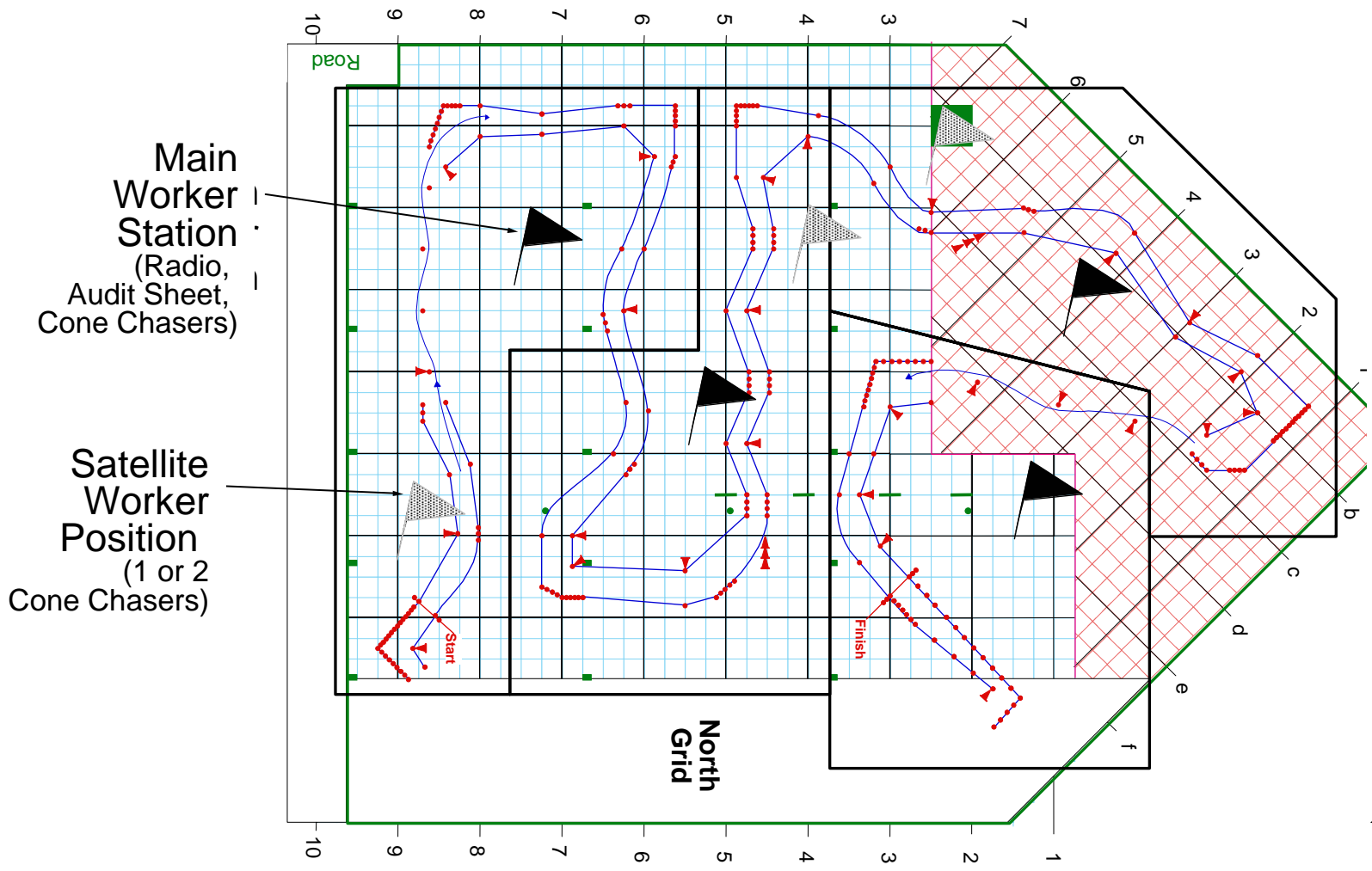


## Worker stations

- Now add the projected course worker stations and projected coverage area
  - Keep coverage distances around 50 yards or less if possible
  - Position near solid objects if possible/available
    - light pole
    - tree
    - planter, etc.
  - Locate workers on the inside of a turn rather than the outside
  - Anticipate possible directions that a car may spin and avoid those areas
  - Prioritize closeness to the cones likely to be hit
    - slalom cones
    - tight apexes
    - outside walls at ends of significant straights, etc.
  - Try to ensure that workers do not have to cross another area of the course to get to a down cone in their coverage area

*So You Have a Blank Piece of Paper*  
**Worker Station Placement**

**Topeka North Course 1995**



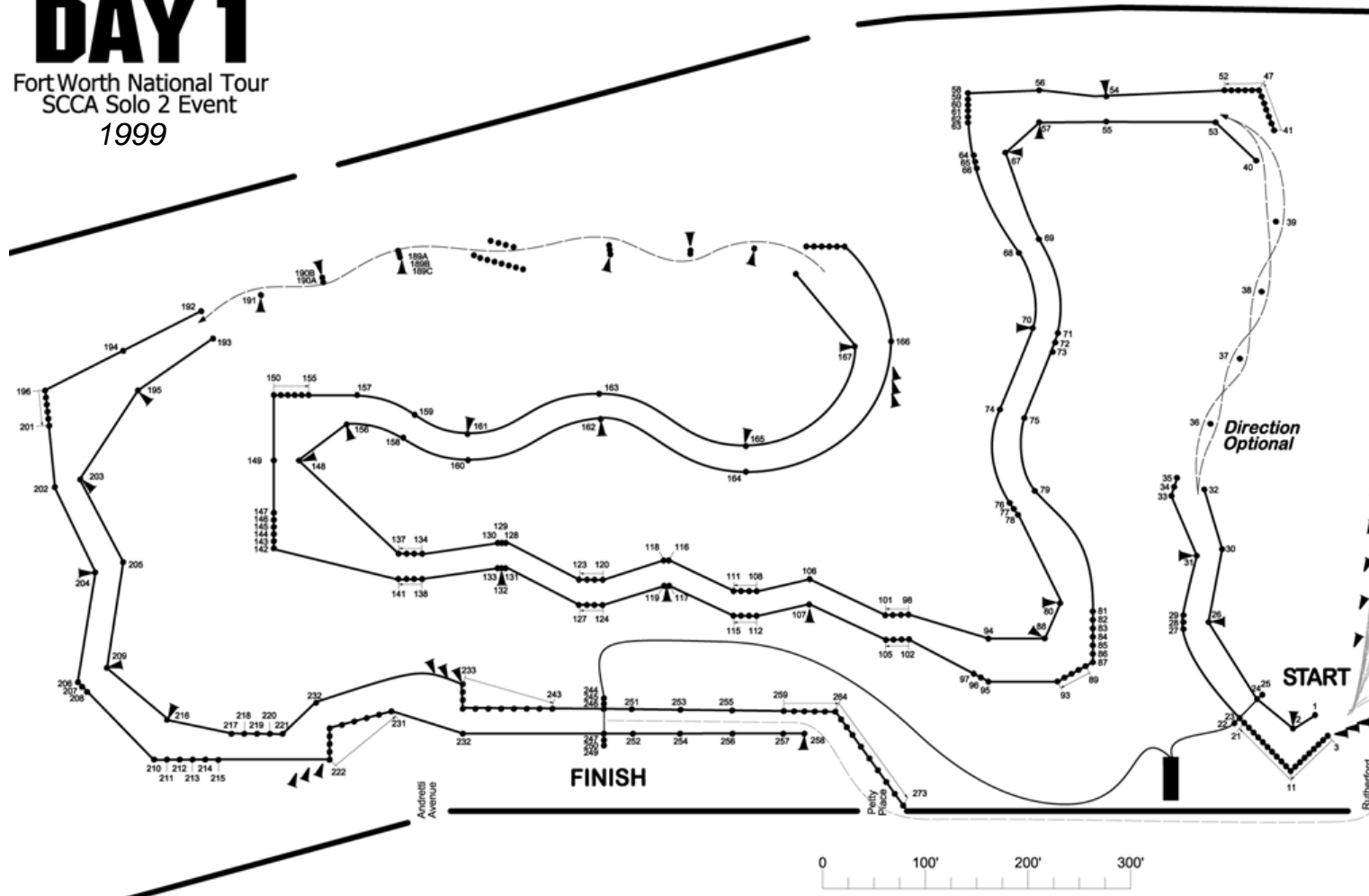


## *So You Have a Blank Piece of Paper* Course Set Up at the Event Site

- Things are not always what they seem - or - I could have sworn they'd have to lift there!
  - It is rare to be able to say that the entire design worked the way it was intended
    - Page 75 shows a course I designed in which the first section turned out to be flat out from the start until the first 90° turn - not what I expected at all!
  - Sometimes it is difficult to spot poor sections on paper but easy to see once the pylons are in place
    - A good designer will exhibit flexibility and make on-site adjustments to allow the course to flow properly
      - Maps, such as the ones included in this booklet, usually have cones in them that are approximately 3-5 feet in diameter - which makes it impossible to be totally accurate
      - Because of this, some course elements which appear to reduce speed on paper may in fact be wide open, as I found out from my example above
      - The converse is true too - some elements which appear to be moderately open will be difficult and tight to drive
- So make adjustments at the event site, make note of your errors and your current and future course designs will benefit

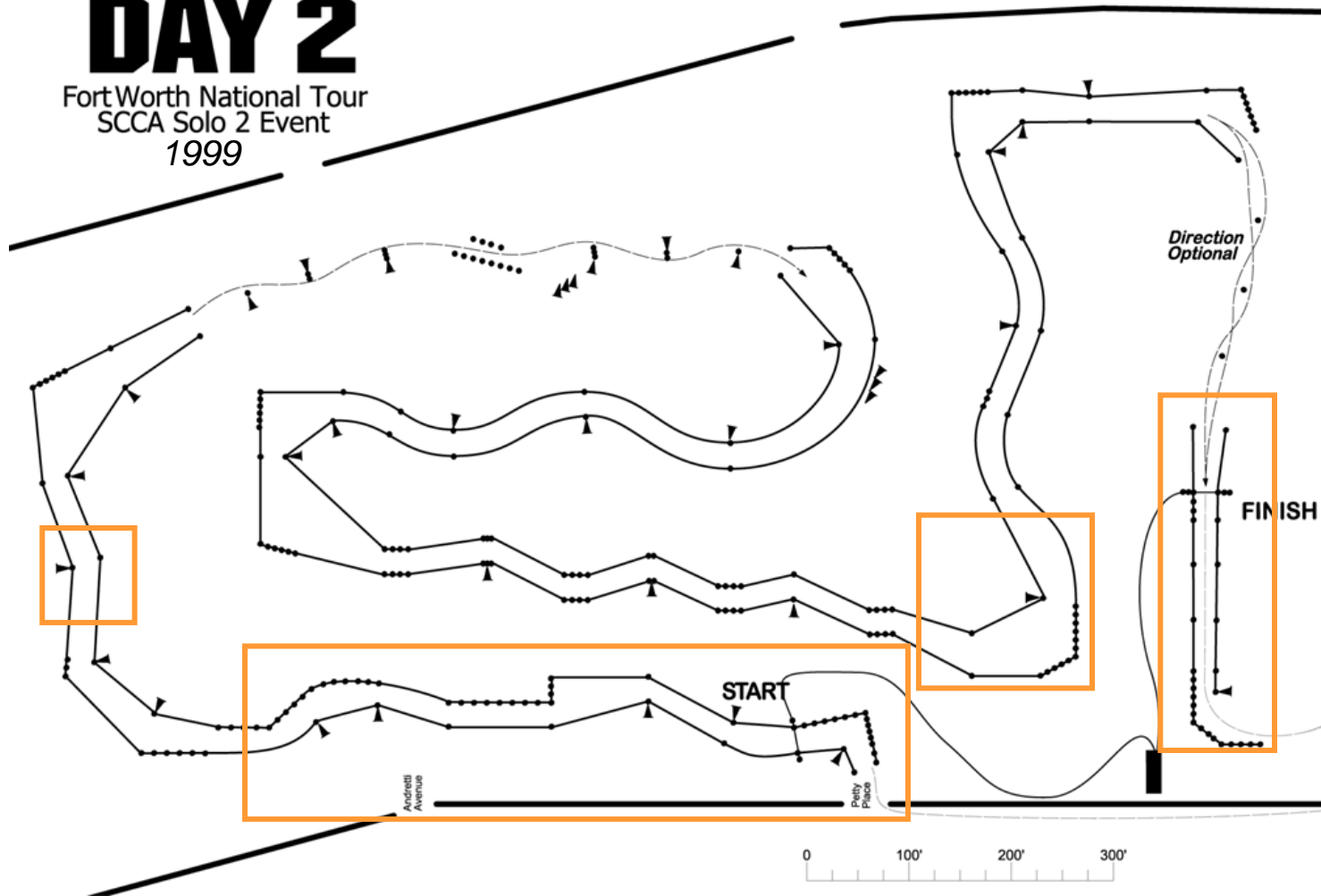
**DAY 1**

Fort Worth National Tour  
 SCCA Solo 2 Event  
 1999



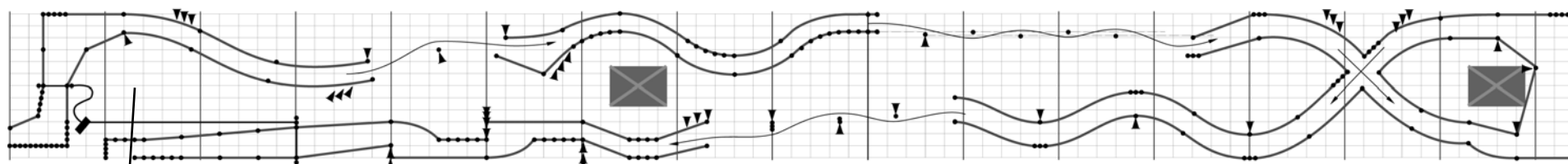
# DAY 2

Fort Worth National Tour  
SCCA Solo 2 Event  
1999



□ Differences between Day1 and 2 besides course direction

*So You Have a Blank Piece of Paper*  
**Long Skinny Sites**



12.5 x 15 grid  
(cement Squares)

- How about a “long and skinny” event site?
  - Avoid slalom down, 180° turn, slalom back
  - Balance between slaloms, sweeping turns, and offset gates, just as you would in an open lot
  - You just have to be more creative to do so... 8^)

# Narrow Road Course Sites

The Houston Region SCCA presents

## LIBIDINOUS ASPHALT GLUTTONY

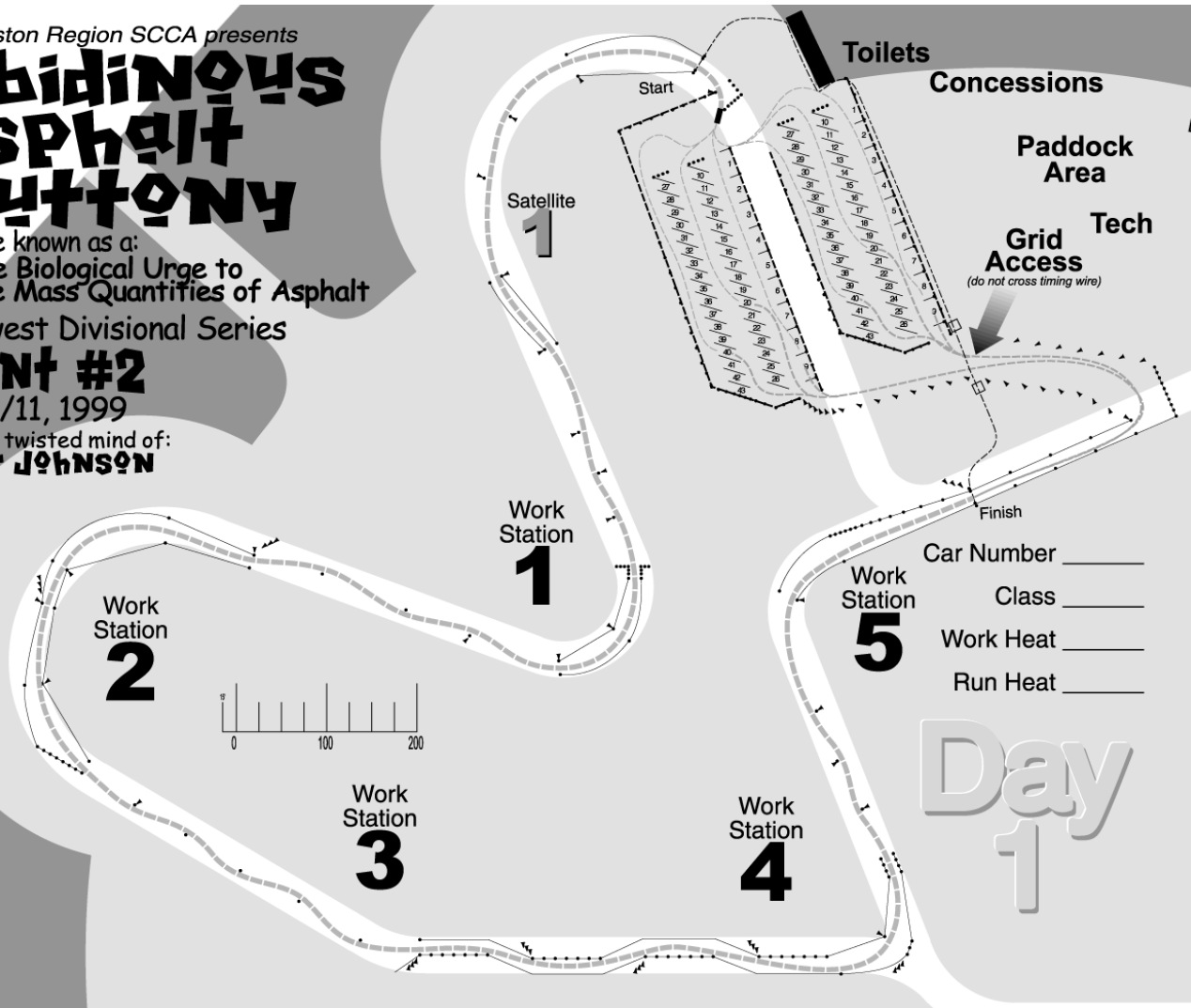
otherwise known as a:  
Primitive Biological Urge to  
Consume Mass Quantities of Asphalt

Southwest Divisional Series

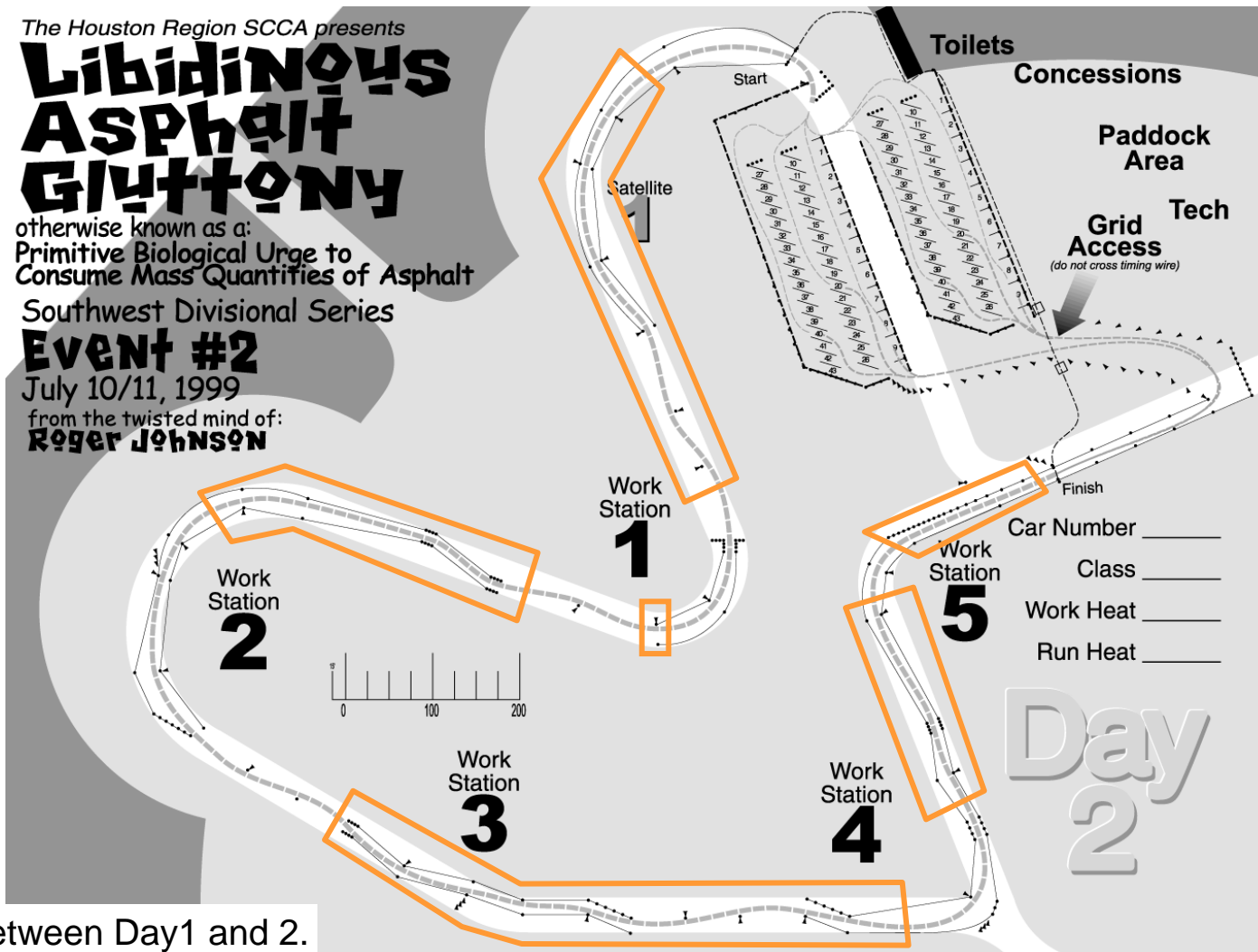
### EVENT #2

July 10/11, 1999

from the twisted mind of:  
**ROGER JOHNSON**

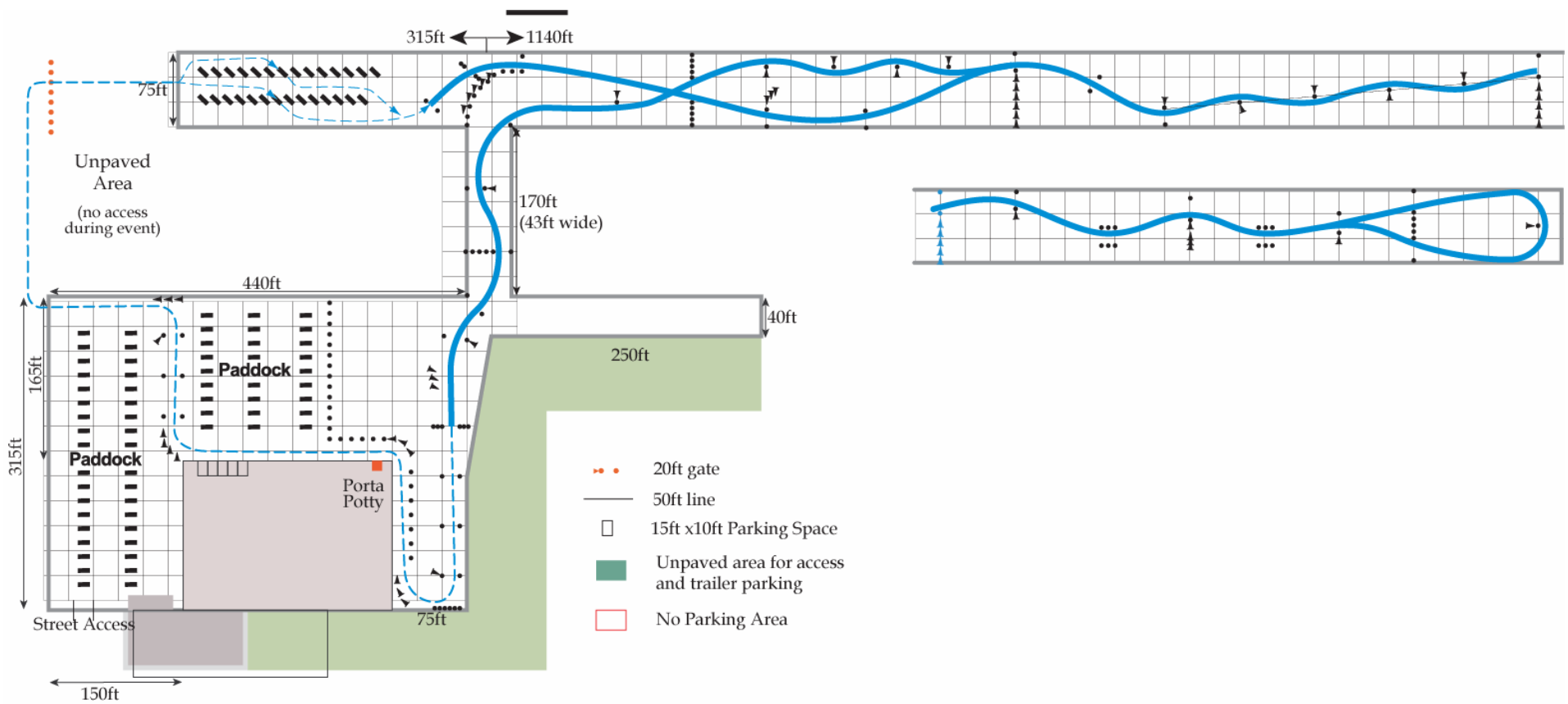


*So You Have a Blank Piece of Paper*  
**Narrow Road Course Sites**  
(continued)

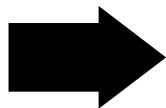


□ Differences between Day1 and 2.  
Note that course direction is same both days

*So You Have a Blank Piece of Paper*  
**Other Difficult Shaped Sites**



- Fundamentals
- 10 Basic Concepts
- Simplicity and Big Event Administration
- So you have a Blank Piece of Paper...

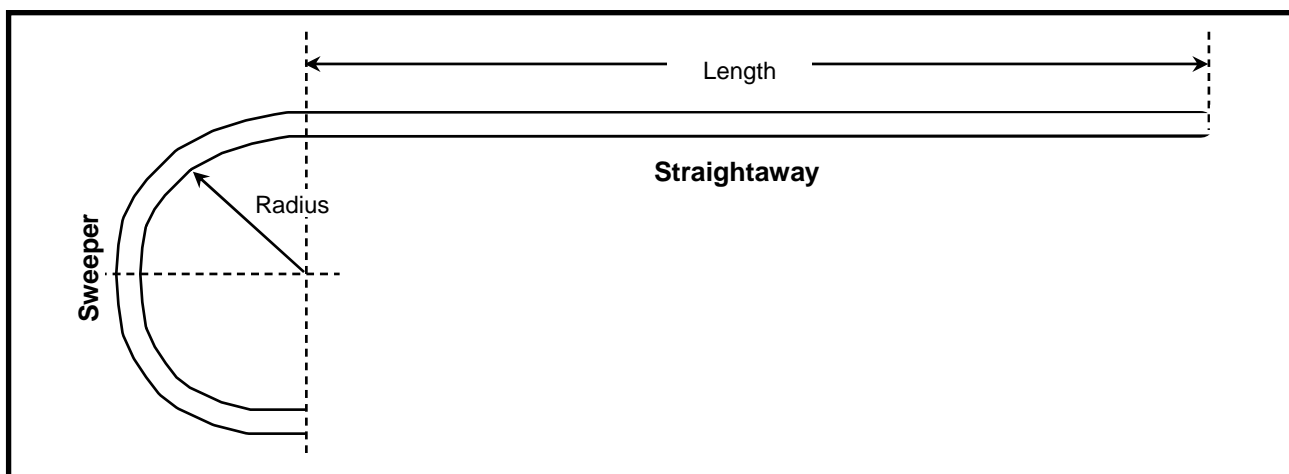


- **Elements, Dimensions and Real Speed**
- Physical Application
- Summary and Questions



# Element Dimensions and Real Speed

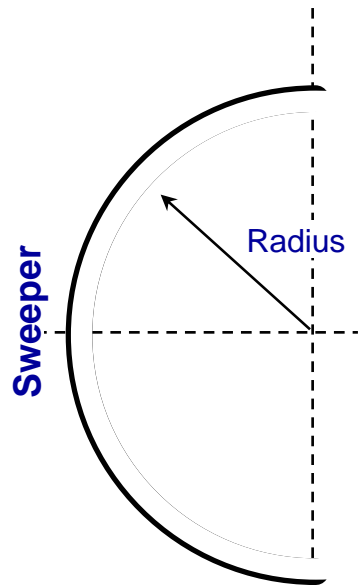
- This section of the book will address is how you, as a course designer, can relate course content and size to how fast the competitors cars might actually go
    - You “Techno-Weenies” (TW) are gonna love this
    - If you are not a TW, this section is still important to understand. It has a real life example as to why you must make your courses “equalizer courses” as outlined in the 6th basic concept (see pages 43 and 44)
- 
- This section will address:
    - Sweeper speeds
      - Radius of a turn
      - Cornering G’s of a car
    - Straightway speeds
      - Length of straight
      - Acceleration times



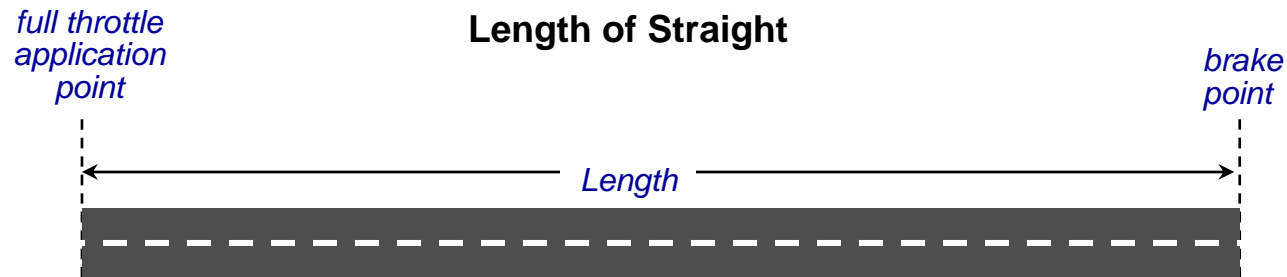
## Disclaimers

- All calculations shown in this section are based on Car magazine road test data.
- The variables include:
  - Type of surface used for testing
  - Type and size of the tires on the car
  - Preparation level of the car
    - shocks
    - alignments
    - bushings, etc.
  - Abilities of the test driver
- Approximations are inherent in the methods used
  - Sweepers are not usually constant radius arcs
  - Straightways often are not perfectly straight
- What makes a quick autocross car is not just pulling high G's and acceleration

- The relationship of the radius of the turn and the cornering G's is shown in the table below:

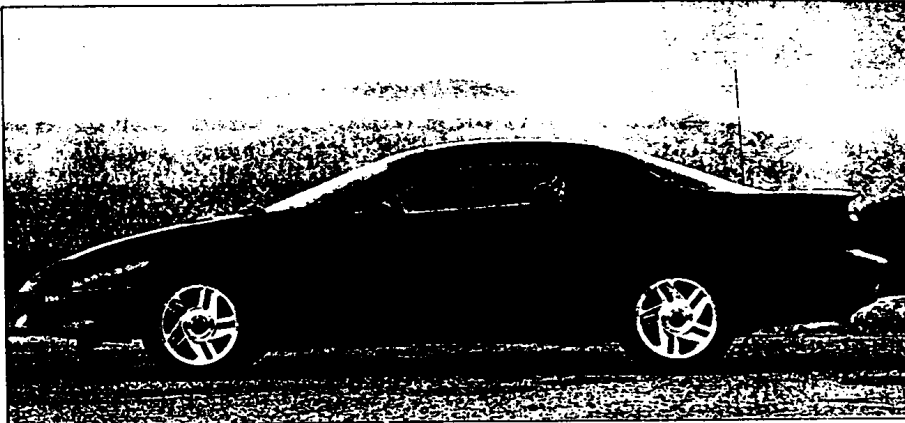


		Miles per hour		
		Radius 50'	Radius 75'	Radius 100'
<b>G Force</b>	0.90	25.9	31.7	36.6
	0.85	25.1	30.8	35.6
	<b>0.84</b> ( '93 Camaro)	<b>25.0</b>	<b>30.6</b>	<b>35.3</b>
	<b>0.82</b> ( '93 Sentra)	<b>24.7</b>	<b>30.2</b>	<b>34.9</b>
	0.80	24.4	29.9	34.5



- Acceleration times
  - Magazine test data (see diagrams on pages 97 and 99) usually include times for:
    - 0 - 30 mph
    - 0 - 40 mph
    - 0 - 50 mph
    - 0 - 60 mph
    - 0 - 70 mph
  - Calculation of distance covered is based on the area beneath the curve on a plot of velocity versus time (see diagrams on pages 98 and 100)

**TECH DATA**



'93 Chevrolet Camaro Z28

**GENERAL**

Make and model ..... Chevrolet Camaro Z28  
 Manufacturer ..... Chevrolet Division,  
                                 General Motors Corp., Detroit, Mich.  
 Location of final assembly plant ..... St. Therese,  
   Quebec, Canada  
 Body style ..... 2-door, 4-passenger  
 Drivetrain layout ..... Front engine, rear drive  
 Base price ..... \$17,195 (est.)  
                                 \$19,812 (est.)  
 Option ..... Dodge Daytona IROC R/T,  
                                 Talon TS

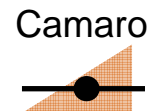
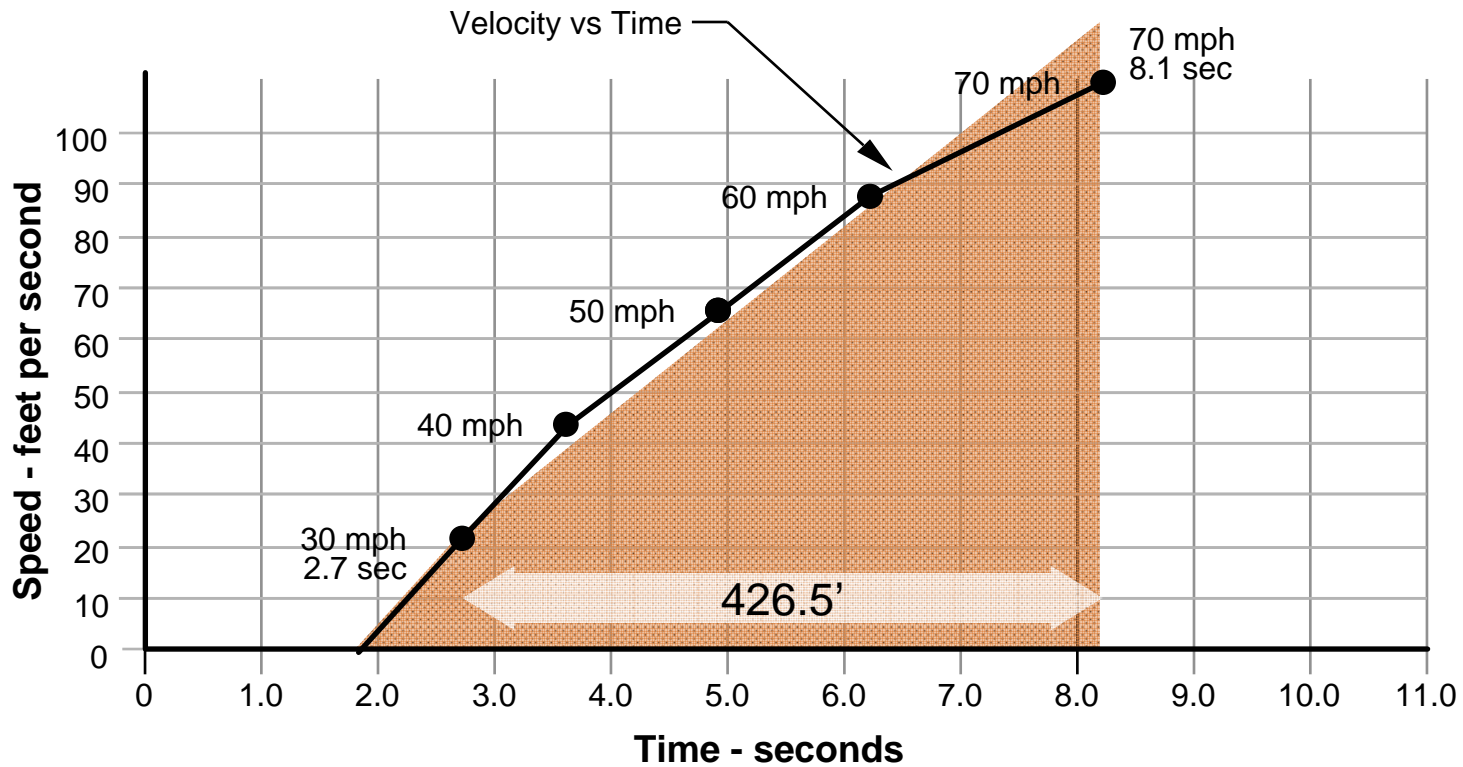
**CHASSIS**

**Suspension**  
 Front ..... Upper and lower control arms,  
                                 coil springs, anti-roll bar  
 Rear ..... Solid axle, multilink with trailing arms  
                                 and track bar, coil springs, anti-roll bar  
**Steering**  
 Type ..... Rack and pinion  
 Ratio ..... 14.4:1  
 Turns, lock to lock ..... 2.3  
 Turning circle ..... 39.0  
**Brakes**  
 Front, type/dia., in ..... Vented discs/10.9  
                                 type/dia., in ..... Vented discs/11.4  
                                 Standard ..... Standard  
 Rear, type/dia., in ..... Standard  
 Tires ..... Standard

**PERFORMANCE AND TEST DATA**

<b>Acceleration, sec</b>	
0-30 mph .....	2.7
0-40 mph .....	3.6
0-50 mph .....	4.9
0-60 mph .....	6.2
0-70 mph .....	8.2
0-80 mph .....	10.0
0-90 .....	12.7
<b>Standing quarter mile</b>	
sec @ mph .....	14.7 @ 96.9
<b>Braking, ft</b>	
30-0 mph .....	31
60-0 mph .....	110
<b>Handling</b>	
Lateral acceleration, g .....	0.84
Speed through 600-ft slalom, mph .....	63.6
<b>Speedometer error, mph</b>	
Indicated	Actual
30 .....	30
40 .....	40
50 .....	50
60 .....	60
<b>Interior noise, dBA</b>	
Idling in neutral .....	62
Steady 60 mph in top gear .....	75

# Camaro Velocity vs. Time



*Under full acceleration from 30 to 70mph, the Camaro will travel 426.25 feet in 5.5 seconds*

*Element Dimensions and Real Speed*  
**Sentra Specifications**

# NISSAN SENTRA SE-R

**PRICE**  
 List price, all POE ..... \$11,370  
 Price as tested ..... ~~est \$14,290~~  
 Price as tested includes std equip. (AM/FM stereo/cassette, elect. aid mirrors, air cond (\$850), power sunroof, ABS, 1600-CD player (est. \$450), Call emitting 87.1, power locking wheel \$20)

**IMPORTER**

0-60 mph ..... 8.1 sec  
 0-¼ mi ..... 16.2 sec  
 Top speed ..... est 125 mph  
 Skidpad ..... 0.82g  
 Slalom ..... 60.2 mph  
 Brake rating ..... very good

SCALE: 10 in (254 mm) DIVISIONS  
 DRAWING BY BILL DOBSON

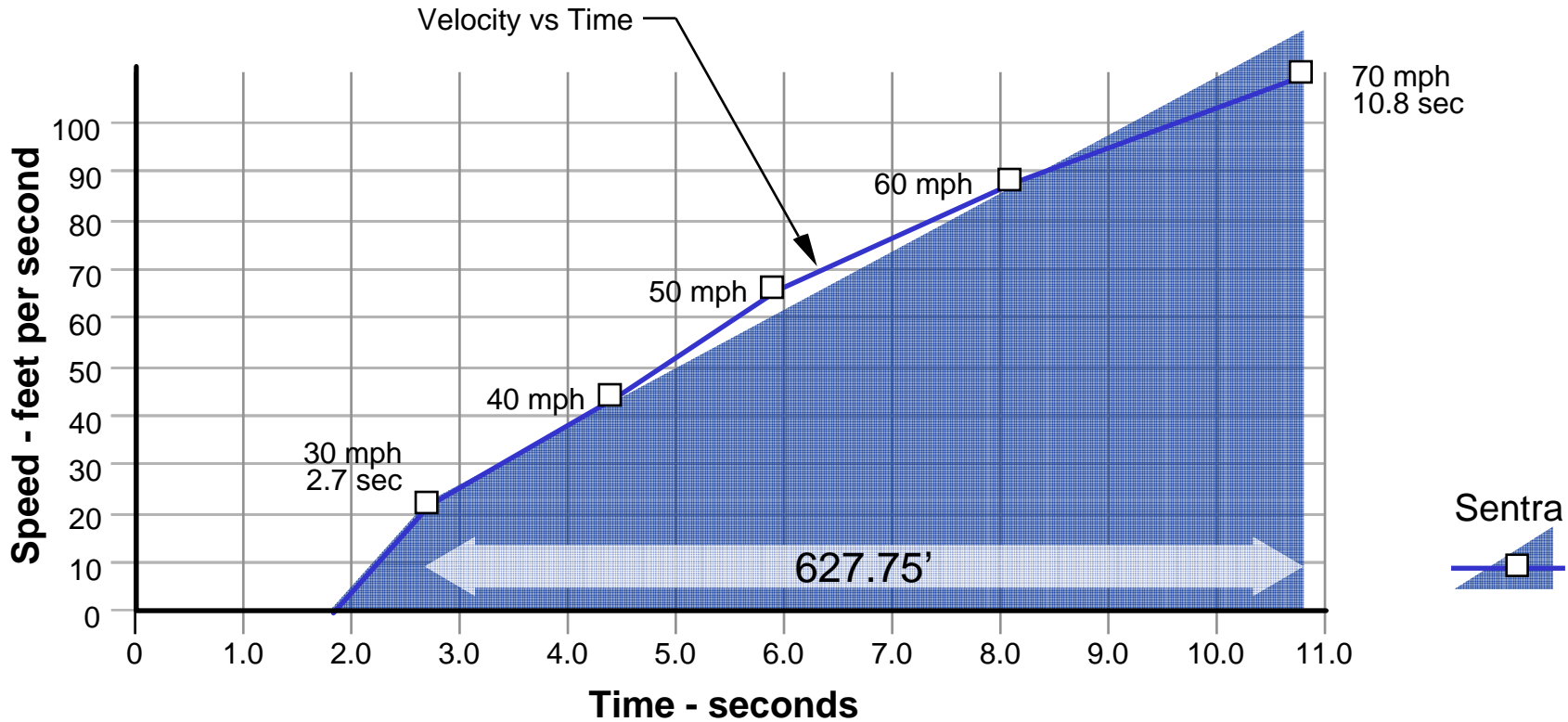
**ENGINE**  
 Type ..... aluminum head & block  
 Displacement ..... 122 cu in./1998 cc  
 Bore x stroke ..... 3.39 x 3.39 in./86.0 x 86.0 mm  
 Compression ratio ..... 9.5:1

**DRIVETRAIN**  
 Transmission ..... 5-sp manual  
 Gear ..... Overall ratio (Rpm) Mph  
 1st ..... 3.07:1 ..... 7.63:1 ..... (7500) 38  
 2nd ..... 1.83:1 ..... 5.37:1 ..... (7500) 63  
 3rd ..... 1.29:1 ..... 4.07:1 ..... (7500) 90  
 4th ..... 1.00:1 ..... 3.16:1 ..... est (6150) 119  
 5th ..... 0.76:1 ..... 4.18:1 ..... 2950

**ACCELERATION**  
 Time to speed ..... Seconds  
 0-30 mph ..... 2.7  
 0-40 mph ..... 3.4  
 0-50 mph ..... 5.9  
 0-60 mph ..... 8.1  
 0-70 mph ..... 10.8  
 0-80 mph ..... 13.6  
 0-90 mph ..... 17.6  
 Time to distance  
 0-100 ft ..... 3.3  
 0-500 ft ..... 8.7  
 0-1320 ft (¼ mi) 16.2 sec 87.0 mph

**BRAKING**

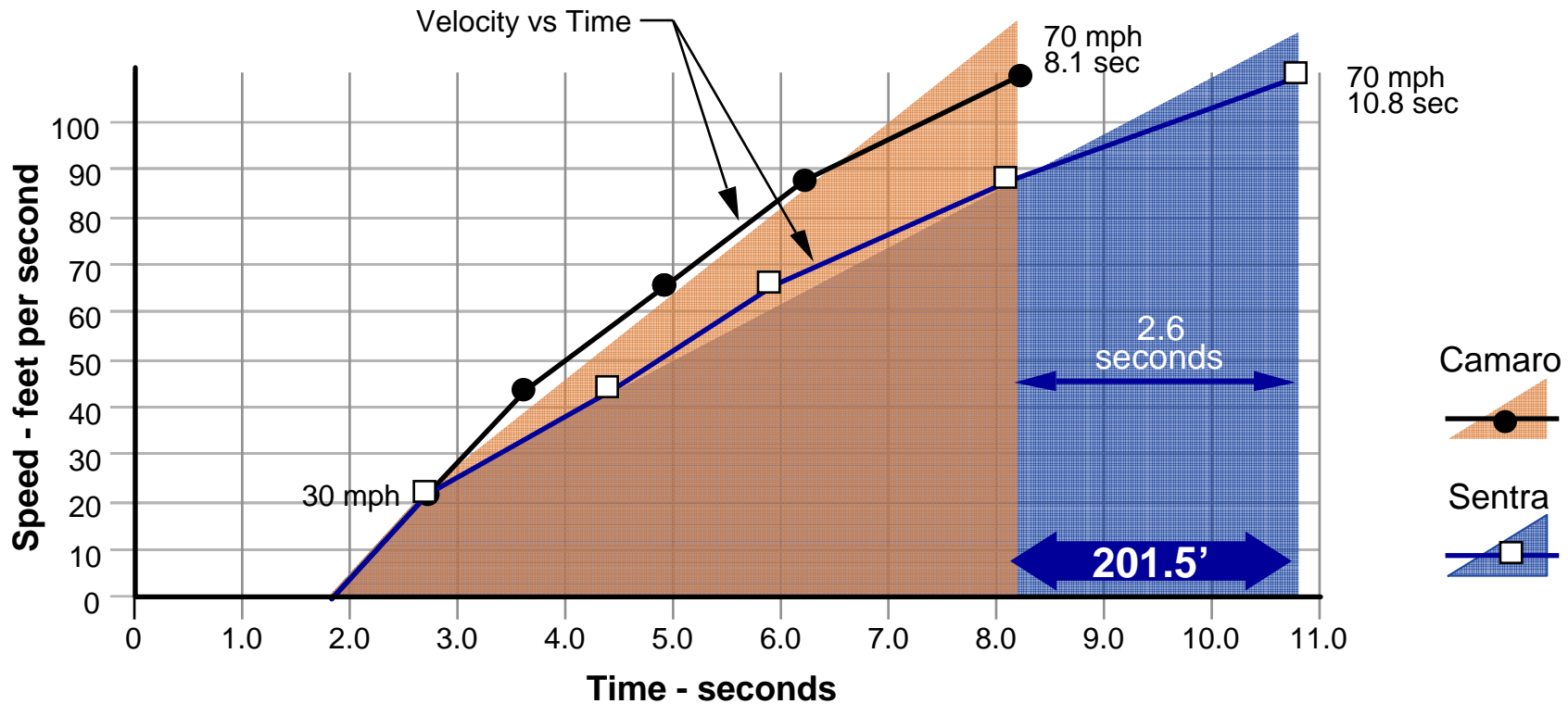
# Sentra Velocity vs. Time



*Under full acceleration from 30 to 70mph, the Sentra will travel 627.75 feet in 8.1 seconds*



*Element Dimensions and Real Speed*  
**Camaro and Sentra**  
Velocity vs. Time



The Sentra would have to travel 2.6 seconds longer and 201.5 feet farther than the Camaro to reach 70 mph

# How a Straight Gives Time to Power

- How much effect can a big straight have on the competition?
  - Compare the transit times already known
    - Camaro:
      - 30 - 70 in 5.5 seconds; 426 feet
    - Sentra:
      - 30 - 70 in 8.1seconds; 628 feet
      - Also reaches 351 feet in 5.5 seconds (Camaro = 426 feet in 5.5 seconds)
      - Finally reaches 426 feet in 6.35 seconds (which the Camaro did .85 seconds quicker)
  - O.K. - so what does that mean?
    - The time advantage for the Camaro over a 426 foot straight section is about 0.85 seconds, or a total distance of 75 feet
  - How could the Sentra make up that difference?
    - Either a secret nitrous container or go faster in the turns
      - To go faster in the turn, it needs a higher entry speed into the straight by 9.2 mph, so it would need to pull about 71% more G's in the sweeper
      - **Hey folks - That's 1.43 G's - and that ain't gonna happen!**

## Why Do We Care?

- How a straight gives time to power
  - O.K. - The Camaro (F Stock) is not classed with the Sentra (G Stock) but classes in Solo II do contain mixtures of cars! For example:
    - (In 2004) B Stock:
      - 2nd Generation Rx7 Turbo
        - 2,850 pounds / 182 horsepower = **15.66 lbs/hp**  
*(where a bigger number = slower acceleration)*
      - 2002 Camaro SS
        - 3,600 pounds (*pig...*) / 345 horsepower (*oh my...*) = **10.43 lbs/hp**
    - That is a **52% difference** between cars in the same class
  - So what does that have to do with a Camaro/Sentra comparison?
    - Sentra
      - 2,600 pounds / 140 horsepower = **18.60 lbs/hp**
    - Camaro
      - 3373 pounds / 275 horsepower = **12.30 lbs/hp**
    - That is a **51% difference** between the cars in our example

The horsepower to weight ratio disparity in our example is approximately the same as the B Stock Rx7T and the Camaro SS, thus illustrating the need for a balance of Power and Handling maneuvers in Solo2 course design

## Speed in Solo2 Course Design

- How fast do we go?
- Why do we care?

**this could be information  
\*some of you\*  
don't want to know...**

## What the Rules Say

- “...should not normally exceed the low 60’s (mph) for the fastest Stock and Street Prepared cars”
  - This doesn’t mean the average: it means the maximum
  - Don’t try to get cute with “normally”

## Why Is Speed Compliance So Important?

- Keywords (from Risk Management):
  - Negligence
  - Gross Negligence
  - Release/Waiver Effectiveness
  - Punitive Damages
  - Compensatory Damages
  - Insurance Rates
  - Coverage Refusal

## What's The Point?

- A good Stock or SP car can get a lot more speed a lot more quickly than many people realize (remember, the rule says “fastest”)
- It's easy to figure these things out in terms of something simple like the length of a straightaway, or the size (radius) of a turn
- This is different from the “I could have sworn they'd have to lift there” problem

## So, Let's Do the Math (ugh...)

- We will figure out:
  - Car cornering G's versus speed versus turn radius; how fast is a car in a particular turn?
  - Car acceleration specs, and the distance it covers getting from "low speed" to "high speed" to "uh-oh"
- Distance from 30-to-trouble is less than many people think



## Cornering G's vs. Speed vs. Radius

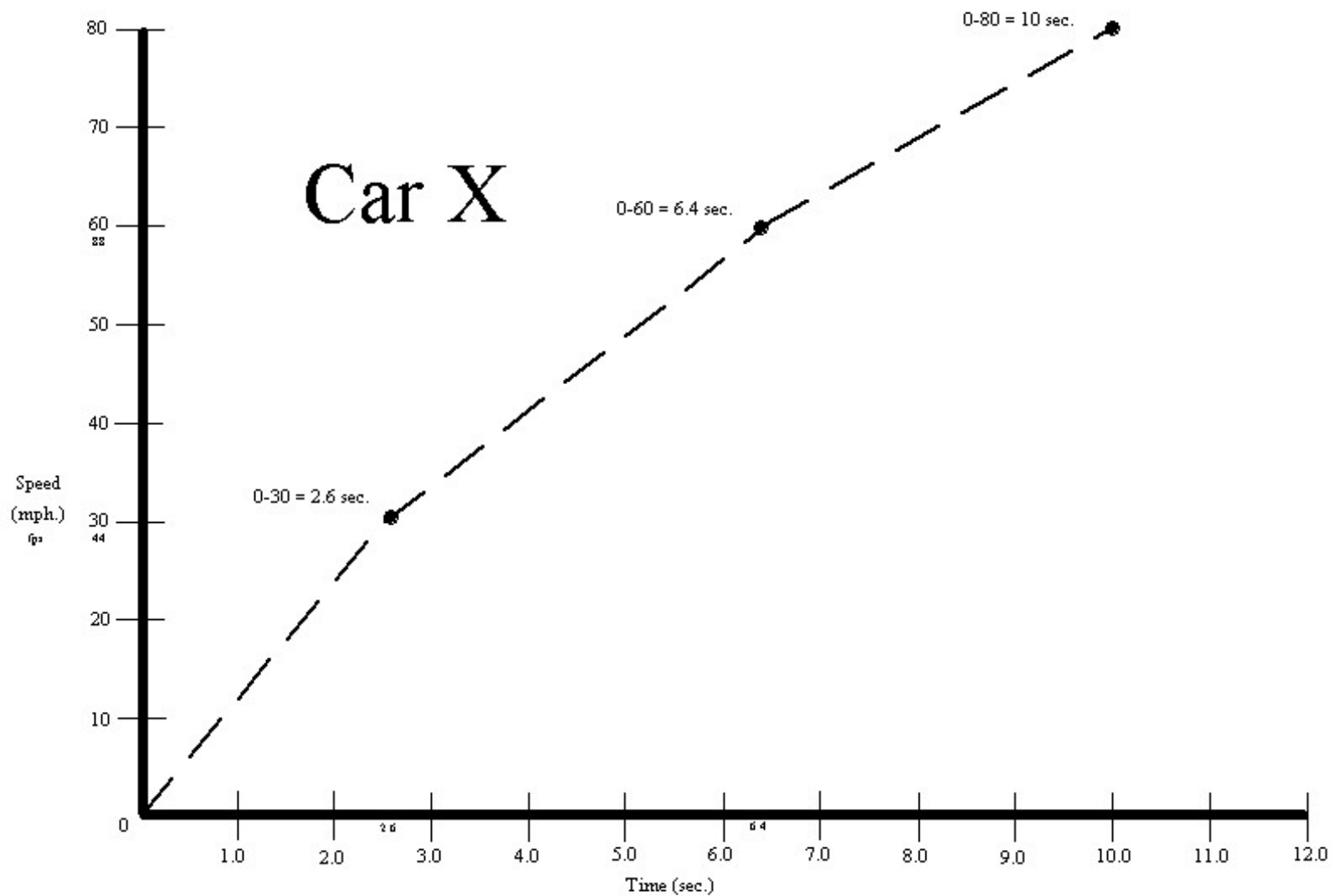
- $G's = (V^2/R) / 32.2$  (where R is in feet, V is in ft/sec)
- $V = \text{squareroot}(G's * 32.2 * R)$  in ft/sec

	<b>50'</b>	<b>75'</b>	<b>100'</b>	<b>150'</b>
<b>0.8 G's</b>	24.47	29.97	34.60	42.38
<b>0.85</b>	25.22	30.89	35.67	43.68
<b>0.9</b>	25.96	31.79	36.70	44.95
<b>0.95</b>	26.67	32.66	37.71	46.18
<b>1.0</b>	27.35	33.50	38.69	47.39

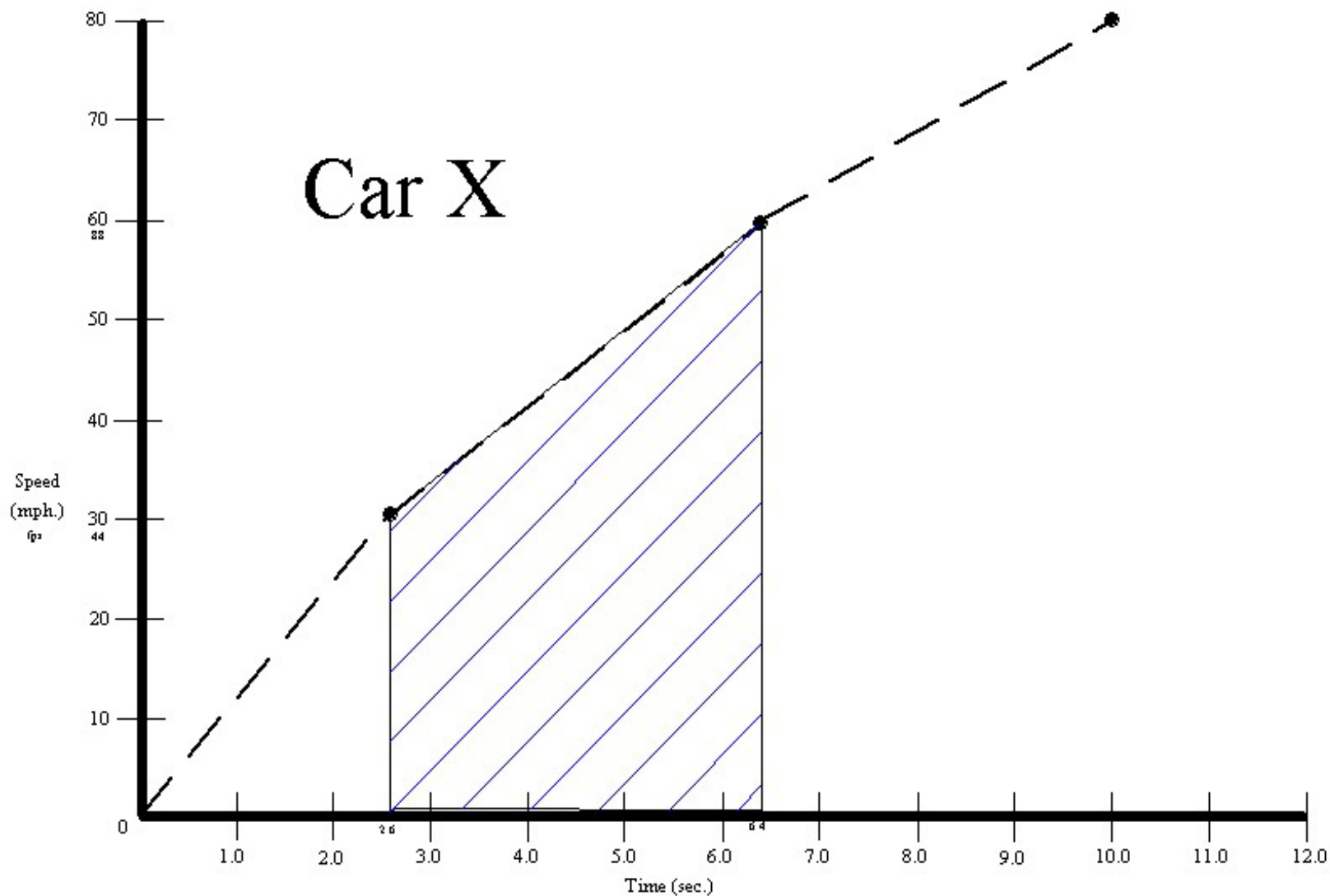
## Calculating Distance-to-Speed

- Data needed is simple; 0-X mph times from car test results (plentiful in magazines and on the web)
  - Without getting too geeky, basically you are:
    - Calculating the area under the curve, after you plot velocity versus time over a known time interval
    - That area is the distance covered in that interval
  - Most speed-versus-time curves are straight enough to simplify and just calculate the area of a rectangle plus the area of a right triangle

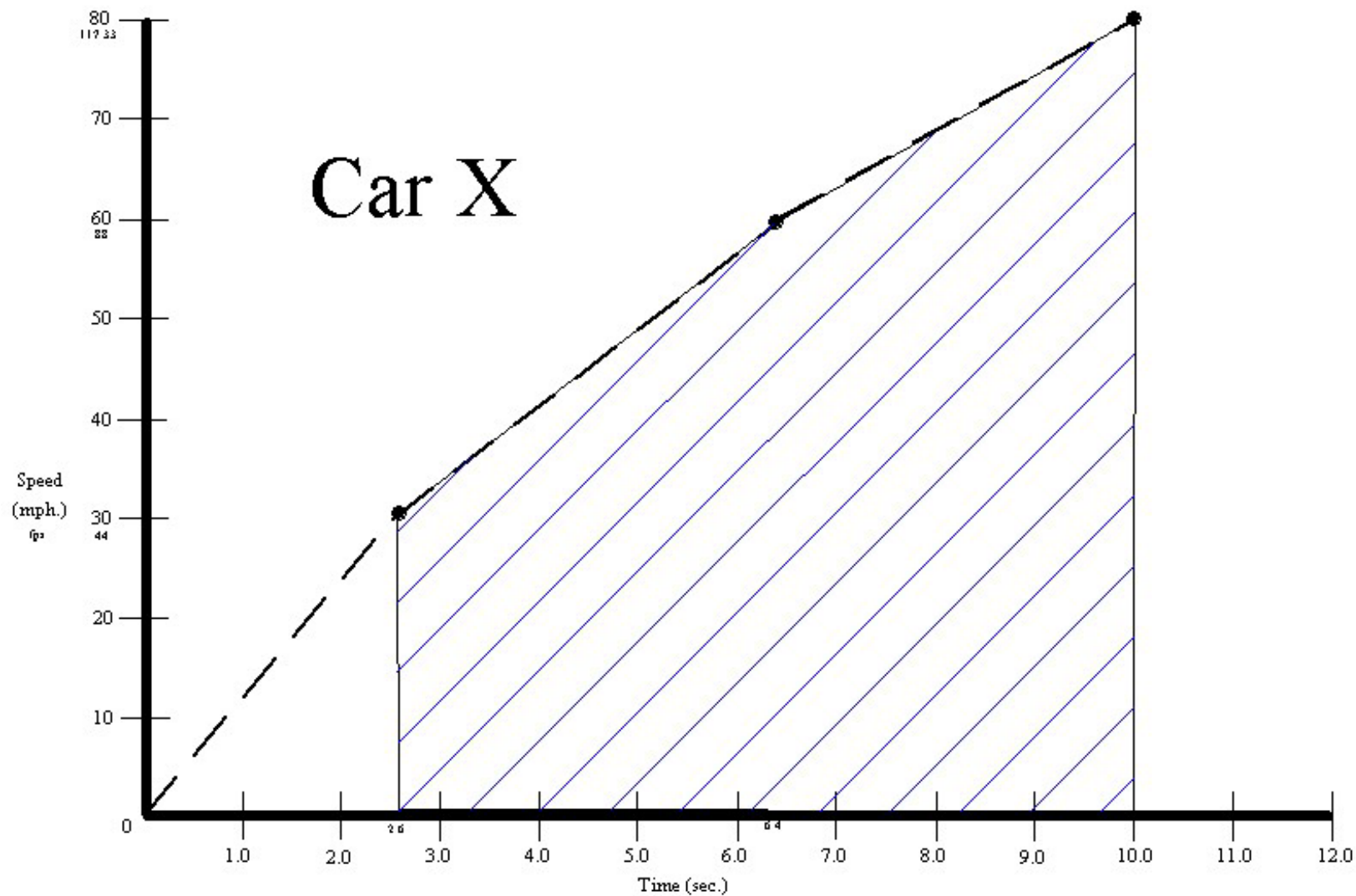
# Calculating Distance from 30 mph to 60 mph



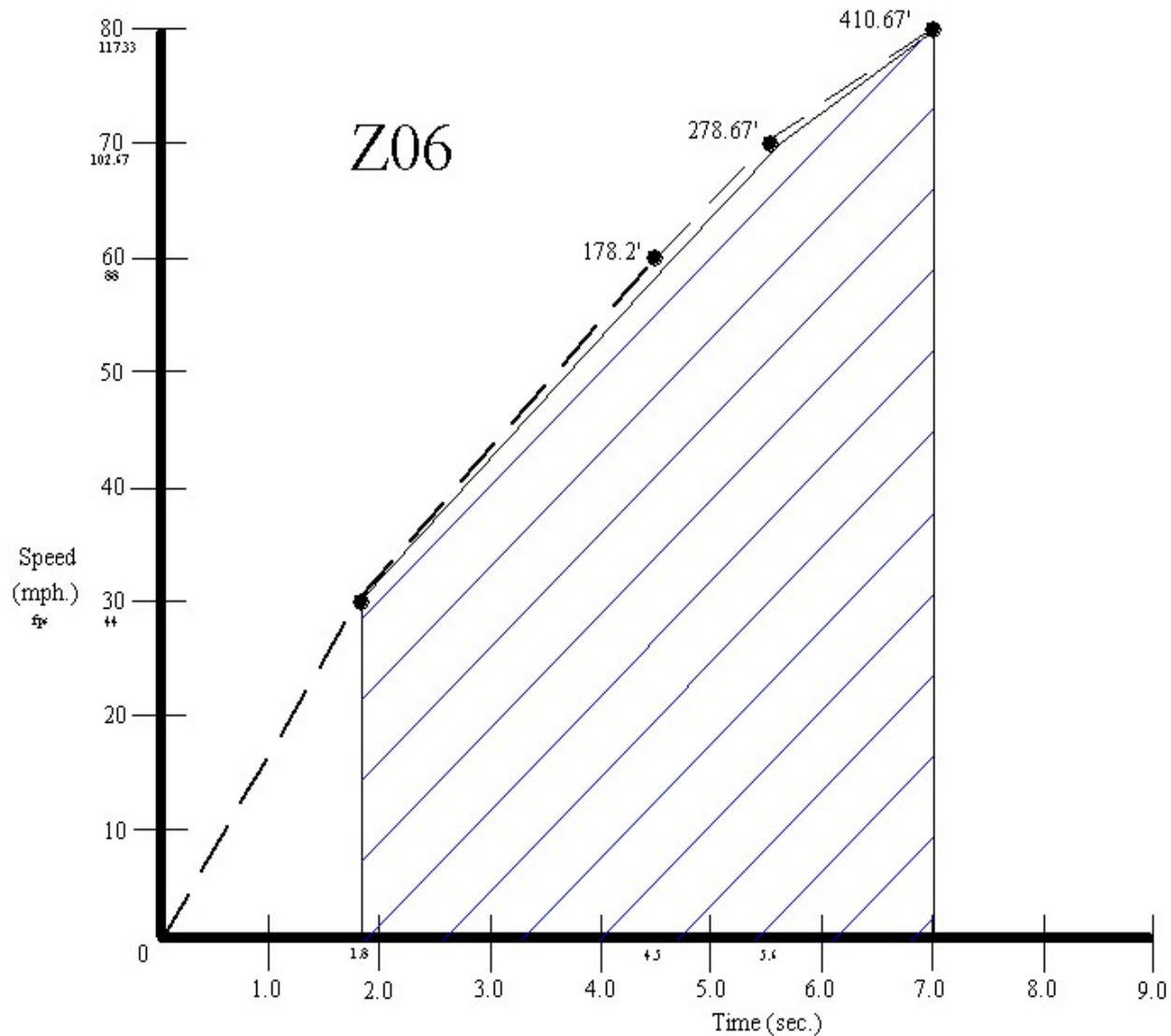
# Calculating Distance from 30 mph to 60 mph



# Calculating Distance from 30 to 60, 80 mph



# Distance from 30 to 60, 70, 80 mph Corvette Z06



## What Does All This Mean?

- A Stock Z06 can get from 30 mph (speed in a sweeper of ~65' Radius) to 80 mph in just over 400 feet
- There are probably SP cars that can do it even quicker
- Pure straights much over 400 feet in length are iffy; much longer ones are just plain irresponsible

## What Can You Do?

- Have higher density of quick elements that are not straights; which can be plenty of fun
  - Connected sweepers (“esses”)
  - Lane changes
  - Big slaloms (70’-80’ spacing)
  - Elements that require throttle modulation and/or even (*horrors*) a little braking



## What Should You Not Do?

- As administrators:
  - Don't let course designers think they have the last word  
(Event Chairs and Safety Stewards do)
  - Don't rationalize "letting it go this time"
  - Don't listen to competitors who whine about not being able to go "real fast"

## What Should You Not Do?

- As designers:
  - Don't focus on "pushing the envelope" with regard to speed
    - Focus instead on delivering a challenging, fun driving experience that provides quality competition
  - Don't put a tightening transient element near the end of a fast stretch, to slow cars down (recipe for sedan rollovers)

## Protect Our Sport

- If Solo2, as the Rules define it, isn't what someone wants to be driving, they should go try something else (e.g. Solo 1, Solo Trials)
- These folks should not be allowed to corrupt our sport into something it was never meant to be: they put us all at risk!

# Acceleration and Braking Distances in Feet

STARTING SPEED IN MPH	TARGET SPEED IN MPH													
	0	20	25	30	35	40	45	50	55	60	65	70	75	80
0	0	8	13	18	25	33	45	58	75	94	118	143	177	213
20	8	0	5	10	17	25	37	50	67	86	110	135	169	205
25	12	4	0	6	13	21	32	45	62	81	105	131	165	201
30	17	10	5	0	7	15	27	40	57	76	100	125	159	195
35	24	16	12	6	0	8	20	33	50	69	93	118	152	188
40	31	23	19	14	7	0	12	25	42	61	84	110	144	180
45	39	32	27	22	16	8	0	13	30	49	73	99	132	168
50	49	41	36	31	25	17	9	0	17	36	60	86	119	155
55	59	51	47	41	35	28	19	10	0	19	43	68	102	138
60	70	62	58	52	46	39	31	21	11	0	24	50	83	119
65	82	74	70	65	58	51	43	33	23	12	0	26	59	95
70	95	87	83	78	71	64	56	47	36	25	13	0	34	70
75	109	101	97	92	85	78	70	61	50	39	27	14	0	36
80	124	116	112	107	100	93	85	76	66	54	42	29	15	0

The acceleration distances in this chart as based on a car which goes 0 - 60 mph in 4.16 seconds. This is estimated to be the maximum acceleration performance of any vehicle at an event.

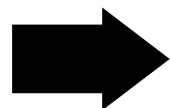
The braking distances are based on a constant 0.8 g braking, and correlate well to typical published vehicle maximum braking effort on street tires. This half of the chart can be used to estimate braking distances of lower performance cars and for estimating stop box length. Be sure to add plenty of margin to the actual stop box length so that all cars can easily stop within the box.

Although the higher performance cars will be able to brake faster than the 0.8 g shown in the chart, this chart can be used to determine a maximum speed attainable on a particular straight. If you have a 150 foot straight which you enter from a 35 mph turn, and which concludes with a 40 mph turn, a well-driven mod car will attain a speed of about 65 mph:

	Start speed	Target speed	Distance
Acceleration section:	35	65	93
Braking section:	65	40	51
<b>Total straight length:</b>			<b>144 feet</b>

# Agenda

- Fundamentals
- 10 Basic Concepts
- Simplicity and Big Event Administration
- So you have a Blank Piece of Paper...
- Elements, Dimensions and Real Speed



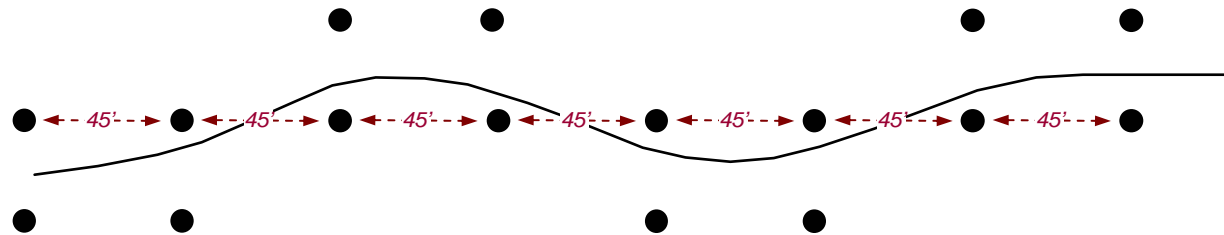
- **Physical Application**

- Summary and Questions

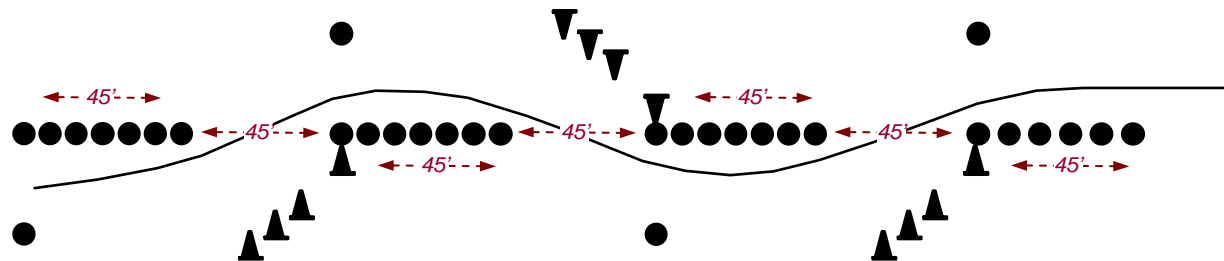
Both of these are lane changes

(Stage cars 100' from examples for drive through - align to lane change center)

1  
Confusing



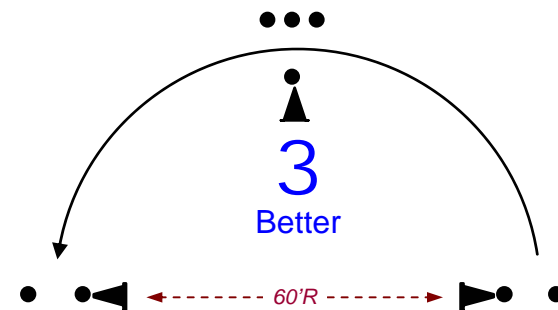
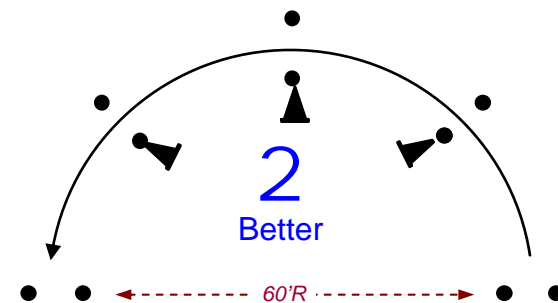
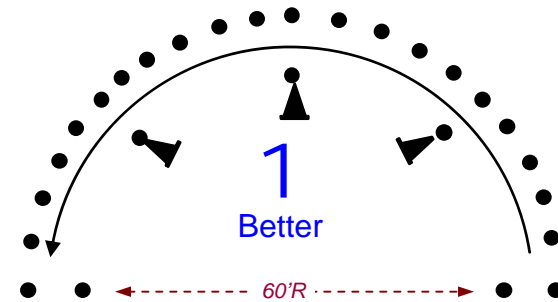
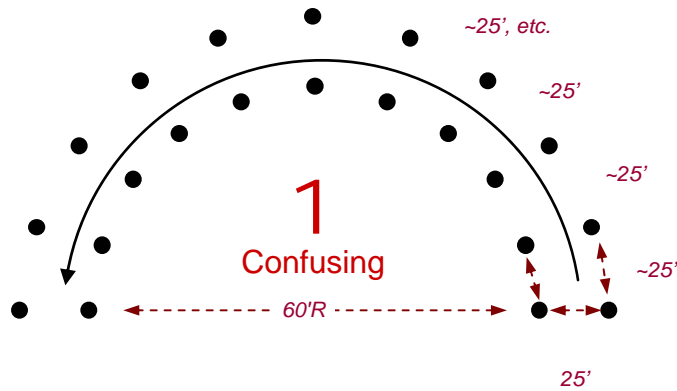
2  
Better



- Concepts applied:
  - Placing gates/walls to avoid visual confusion

All three of these are the same sweeper

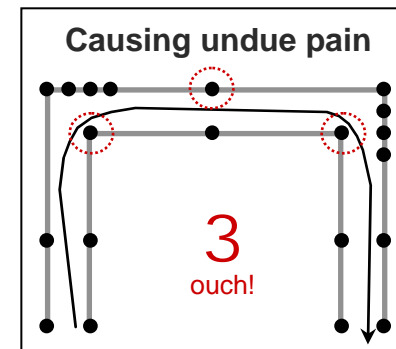
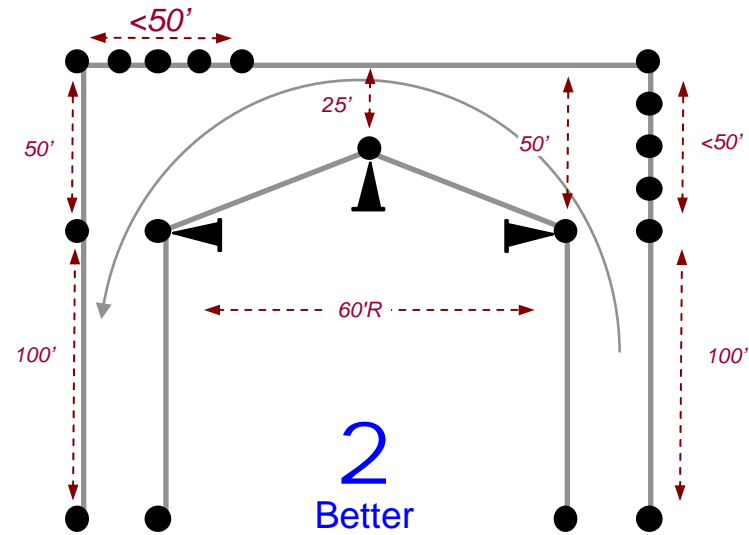
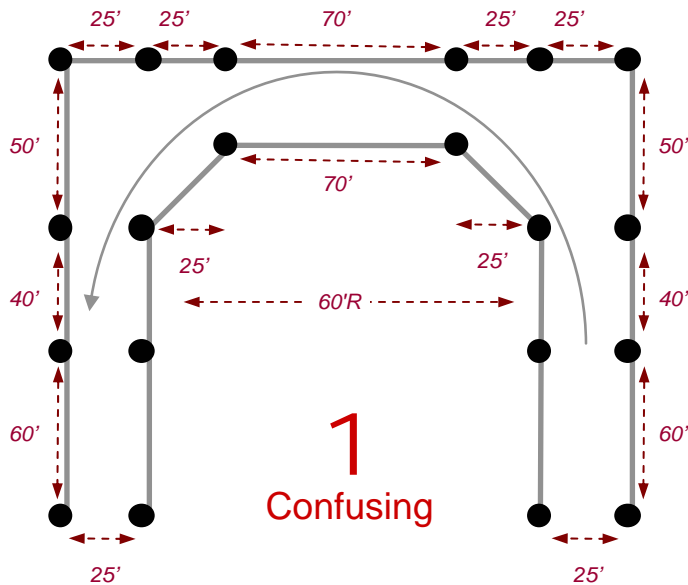
(Stage cars 100' from examples for drive through - align to sweeper entry)



- Concepts applied:
  - Do not space gates at distances similar to gate width
  - Keep next gate within driver's peripheral vision

Both of these are Box Turns

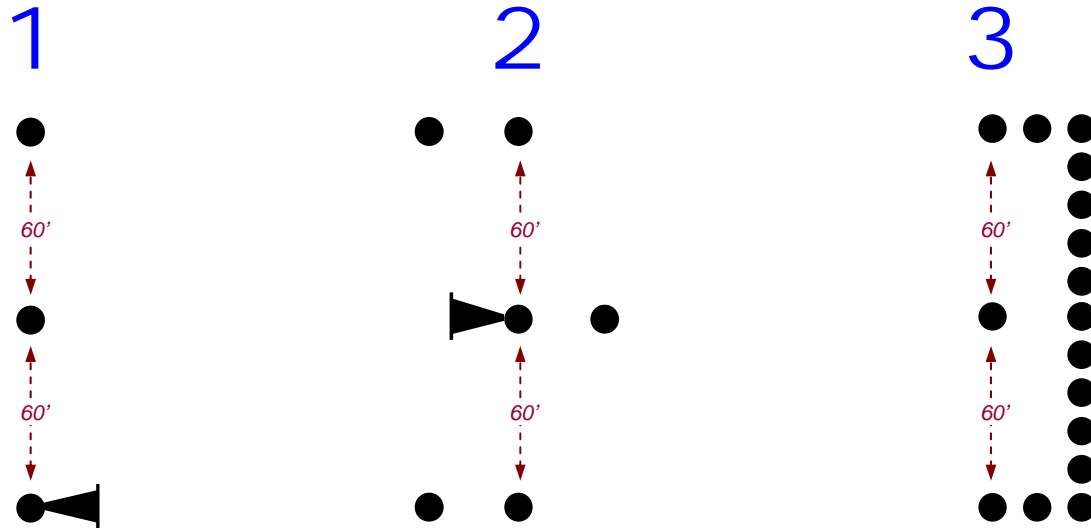
(Stage cars 100' from examples for drive through - align to box turn entry)



- Concepts applied:
  - Placing gates/walls to avoid visual confusion
  - Avoid “painful”walled in turns



All three of these are a slalom - the same maneuver  
(Stage cars 100' from examples for drive through - align to slalom center)



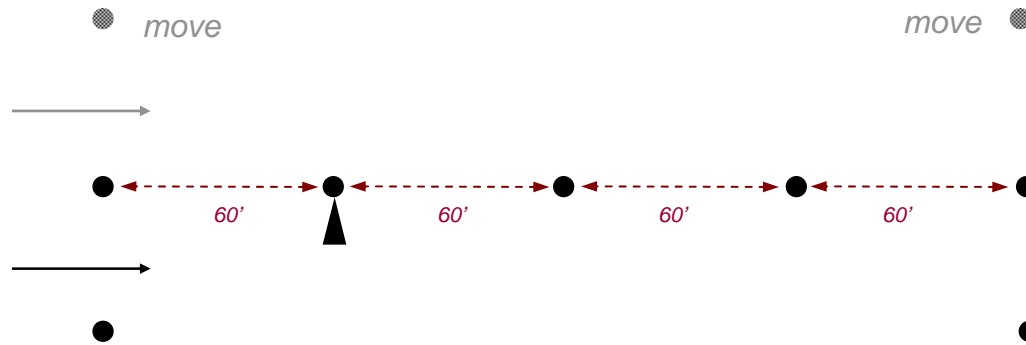
- Concepts applied:
  - Taking a usual maneuver and changing to make it more interesting - not to make it painful!
  - Setting usual maneuvers in a visually different manner

Placement Placement Placement...  
 Tweak the "Before and Afters"  
 at the Event Site

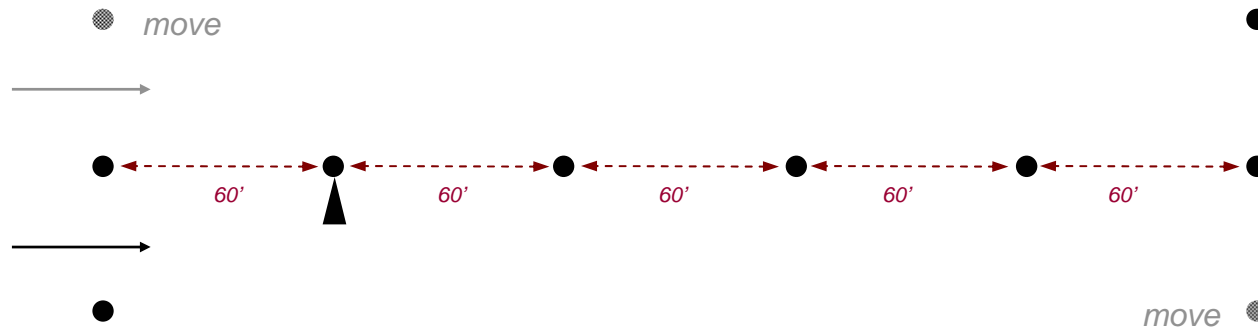
Maneuver Entry location

(Stage cars 100' from examples for drive through - align to entrance)

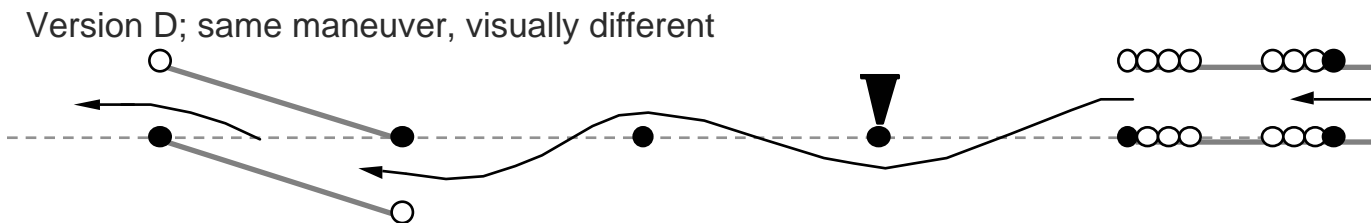
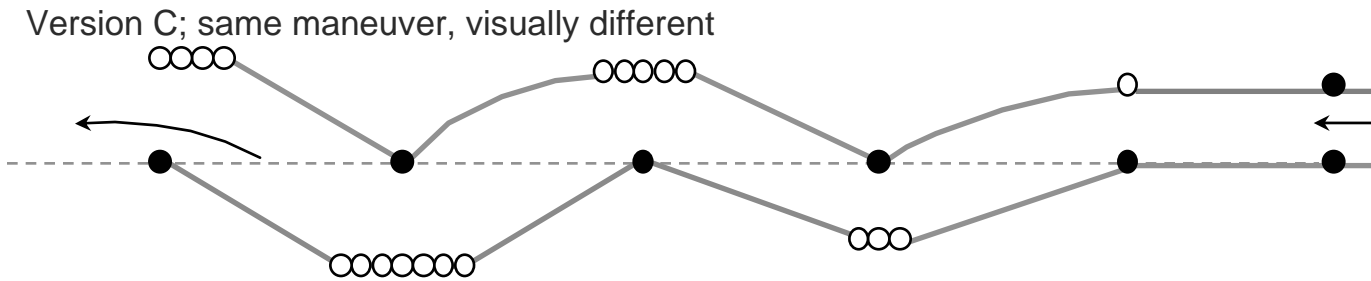
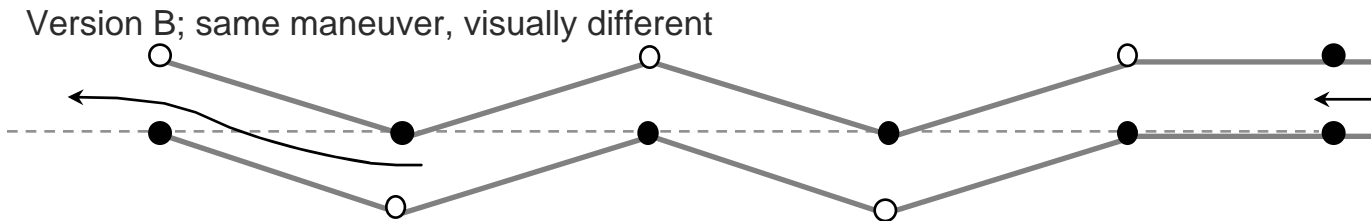
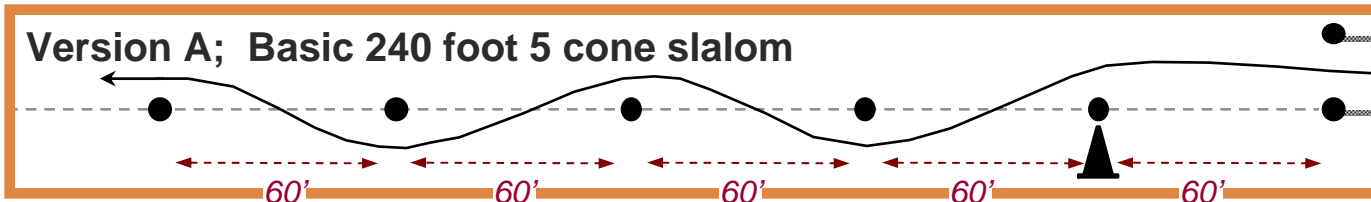
3  
 cone slalom



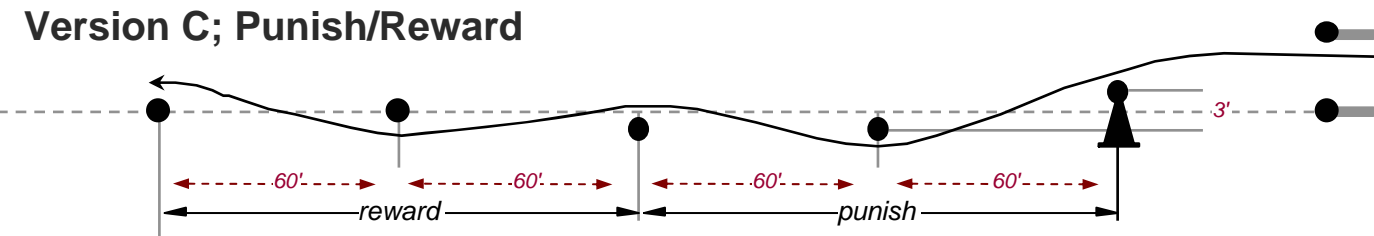
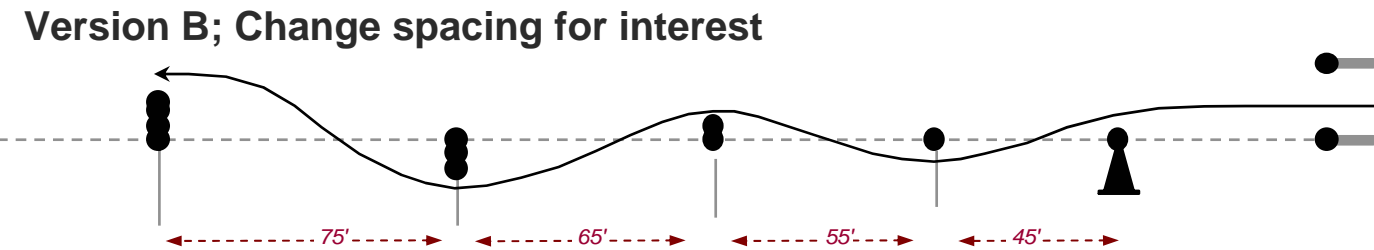
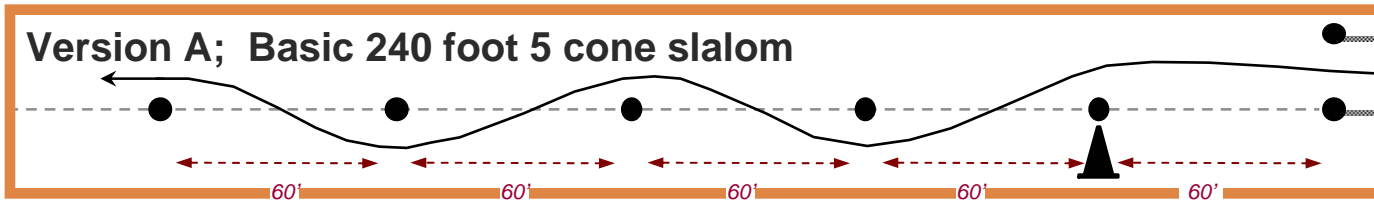
4  
 cone slalom



# 5 Cone Slalom



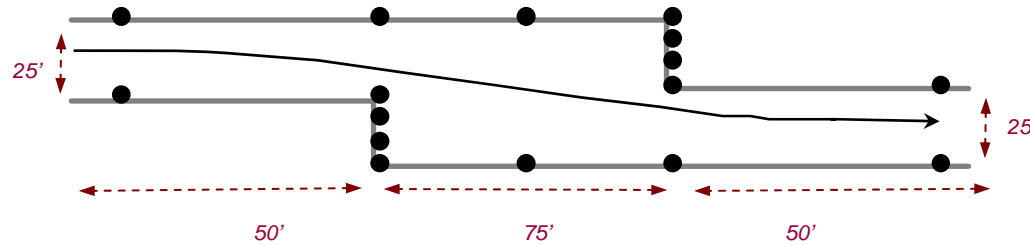
*Feel the Force*  
**5 Cone Slalom**  
 (continued)



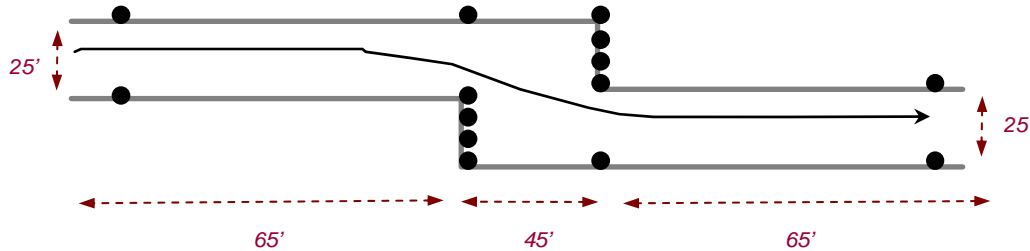
### Lane Change

(Stage cars 100' from examples for drive through - align to exit)

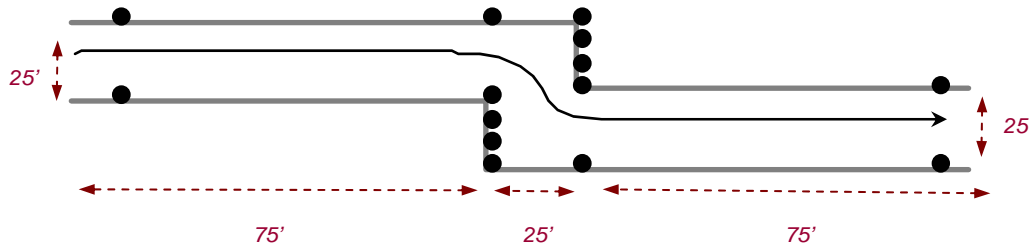
1  
not



2  
is

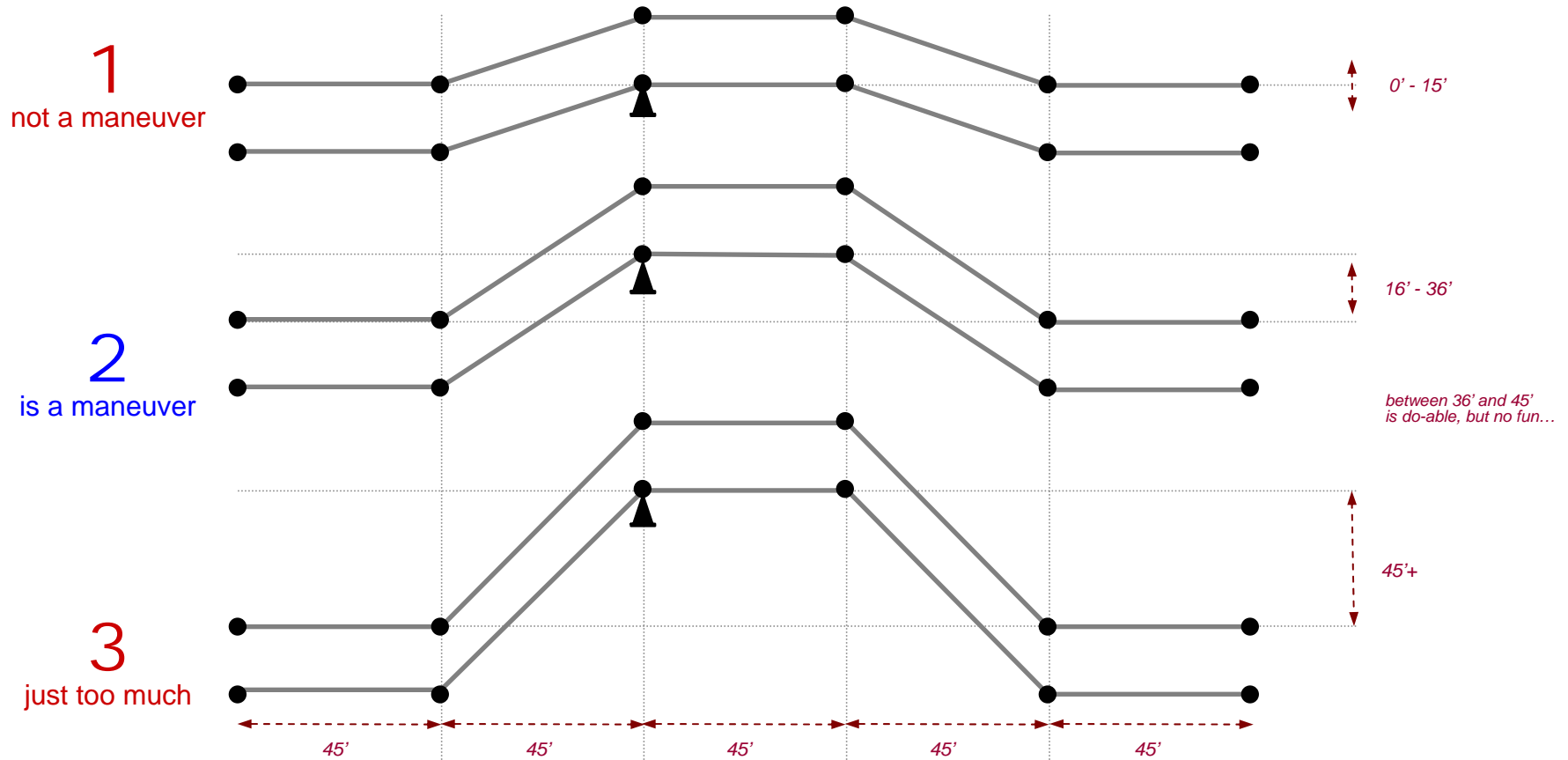


3  
too much



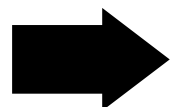
### Chicane

(Stage cars 100' from examples for drive through - align to entrance)



# Agenda

- Fundamentals
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- **Summary and Questions**

## Summary (finally...)

- If you have made it this far without falling asleep or giving up, you are to be congratulated - or at least, you qualify as a course designing data hound...
- Seriously, there is enough information here that you cannot possibly digest it all in one read through. I encourage you to keep this booklet and refer to it when designing Solo II type courses.
- I'd like to reiterate that this is a compilation of the experiences of **Karen Babb, Gregg Lee, Jim Garry, Team.Net** and myself, **Roger H. Johnson**. I would like to thank the others for their ideas in the creation of this booklet. Hopefully I have not let my personal opinions overshadow any "truths".
- Remember, the more courses you design and set up, the better your courses will be

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*Please feel free to contact me with any questions you may have.*

*I can be reached as listed below:*

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